CANADIAN MACHINERY AND MANUFACTURING NEWS

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SMALL TOOLS

Pratt & Whitney Adjustable Blade Reamers

These reamers have eccentric relief and can be set to size without regrinding. They are unexcelled for design and simplicity and ease of adjustment.

The eccentrically relieved blades are stronger than others, do not chatter, and produce a smoother hole. The hand, shell and fluted chucking reamers have interchangeable nuts, screws and wrenches. The bottom of a hole can readily be faced.

By a simple adjustment of the blades the reamer can easily be set to size, without regrinding.

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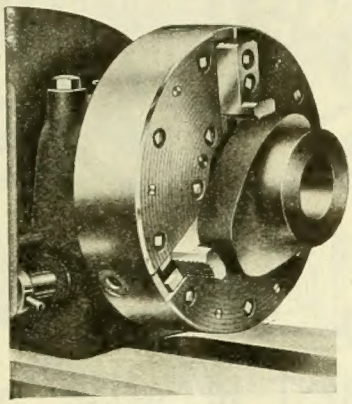
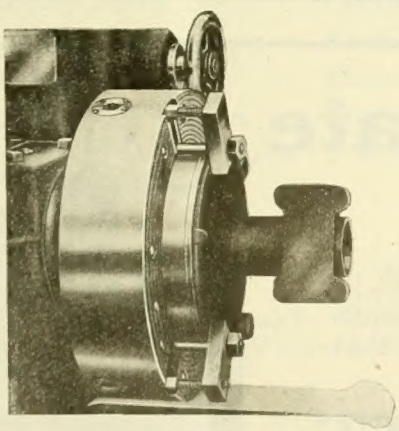
The "Coventry" Chuck

Below are shown one Standard and one Special application of the "Coventry Chuck"



Standard reversible jaws set for gripping irregular or eccentric work. The gas engine cam is made from a mild steel stamping with 3-inch hole drilled into solid metal. The chuck is our 15-inch size. After the jaws have been properly set, work like this is gripped and chucked as easily as any circular object and much quicker than if a four-jaw chuck were used.



The Coventry Chuck used as a face plate fixture, the object in this instance being clamped back on a locating ring, and a stem fitting into the bore of the chuck. The clamps are held from the T slots in the jaw slides. The chuck here is used for a second operation on the part shown at the left. Use of the chuck in this way saves the trouble and time of taking it off and putting on a special face plate fixture.

Adaptability

In addition to being exceptionally strong, the "Coventry" Concentric Chuck is also adaptable to a large variety of special work which is outside the scope of standard self-centering chuck. The exceptionally long bearing surfaces of the jaw slides permit the use of a wide range of special jaws.

These can readily be made by the user, no expensive scroll cutting apparatus being required; the only special tool necessary is a hob, which we carry in stock. The standard soft jaws can be shaped to suit irregular work, thus frequently saving the cost of special fixtures.

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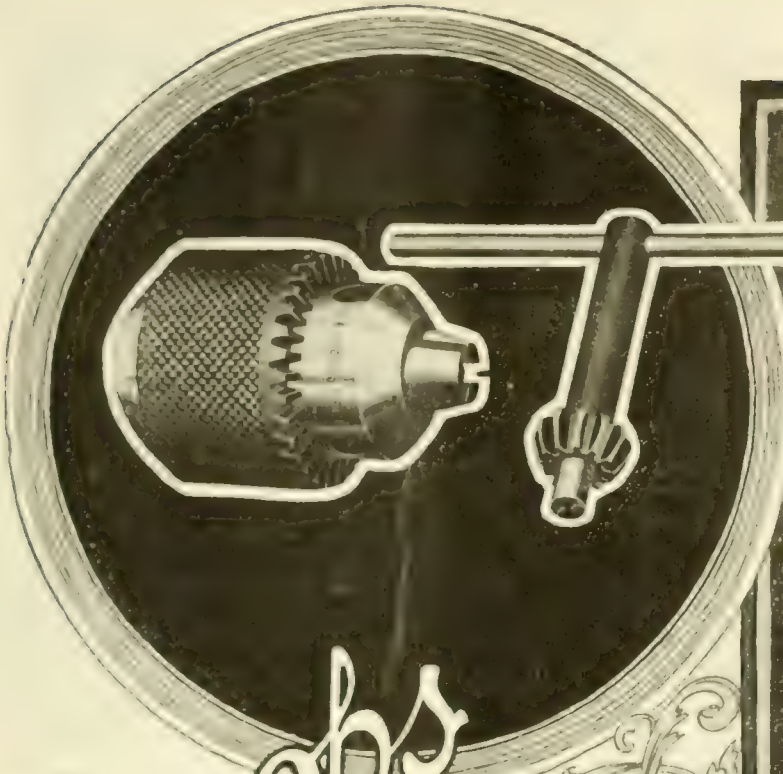
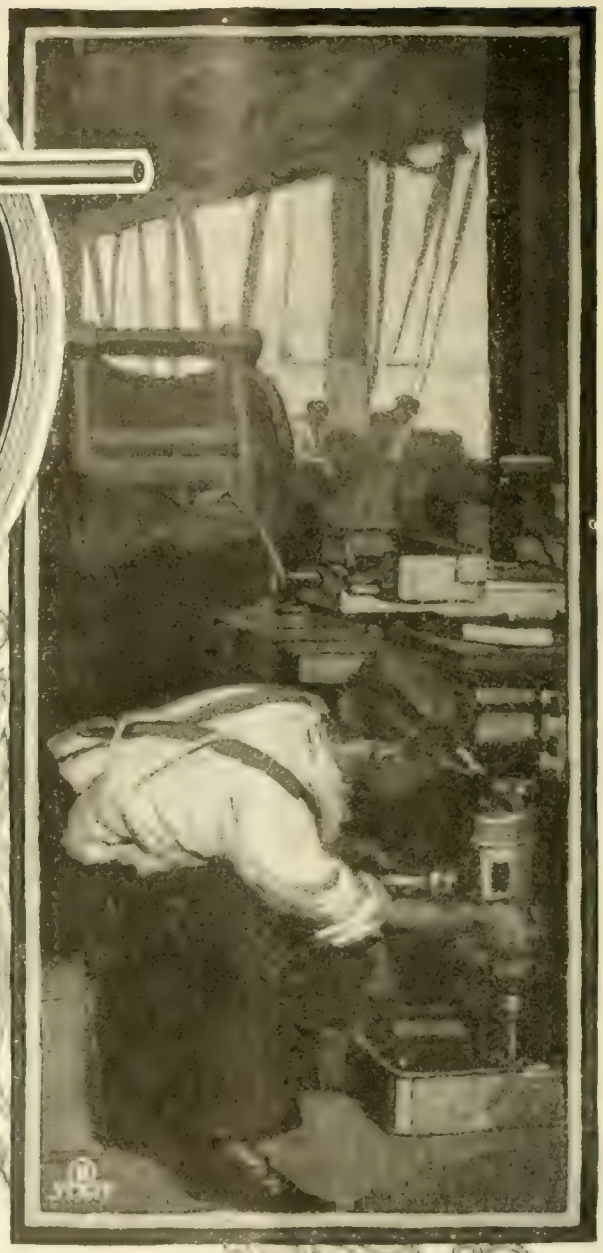




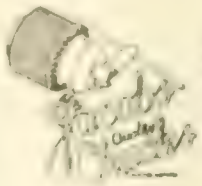
Jacobs Quality Chucks

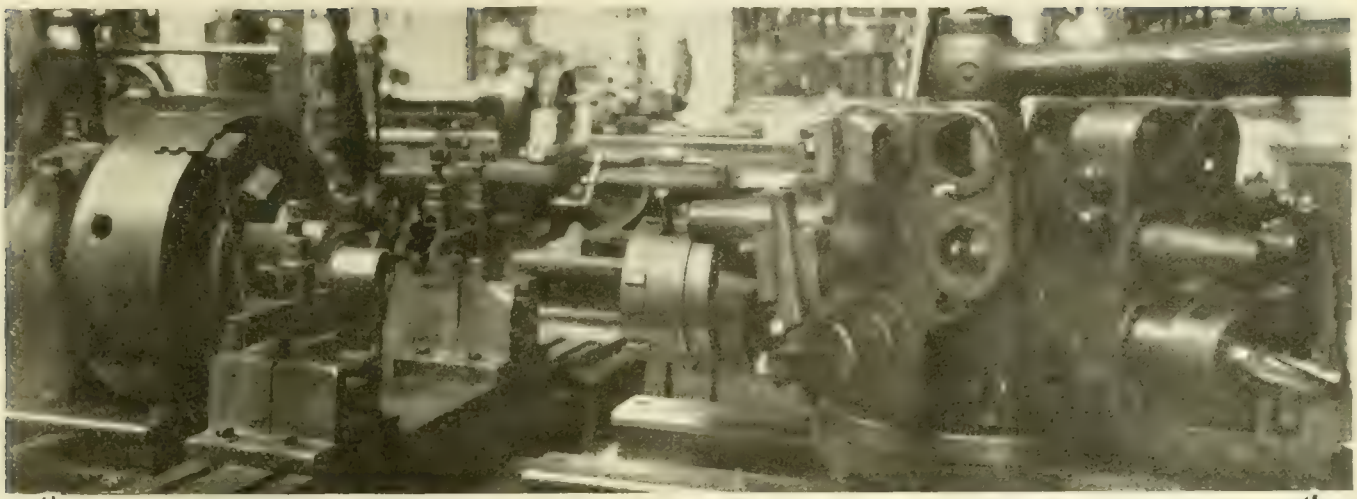
You [illegible] the value of [illegible] and you [illegible] know [illegible] that a Jacobs Quality Chuck will drive [illegible] — not [illegible] — [illegible] faster, truer and more [illegible] than any other chuck in the world.

[illegible] that over 75 per cent. of the [illegible] machine builders have [illegible] on the Jacobs [illegible] preference [illegible] their product.

The Jacobs Manufacturing Co.

Hartford, Conn., U.S.A.





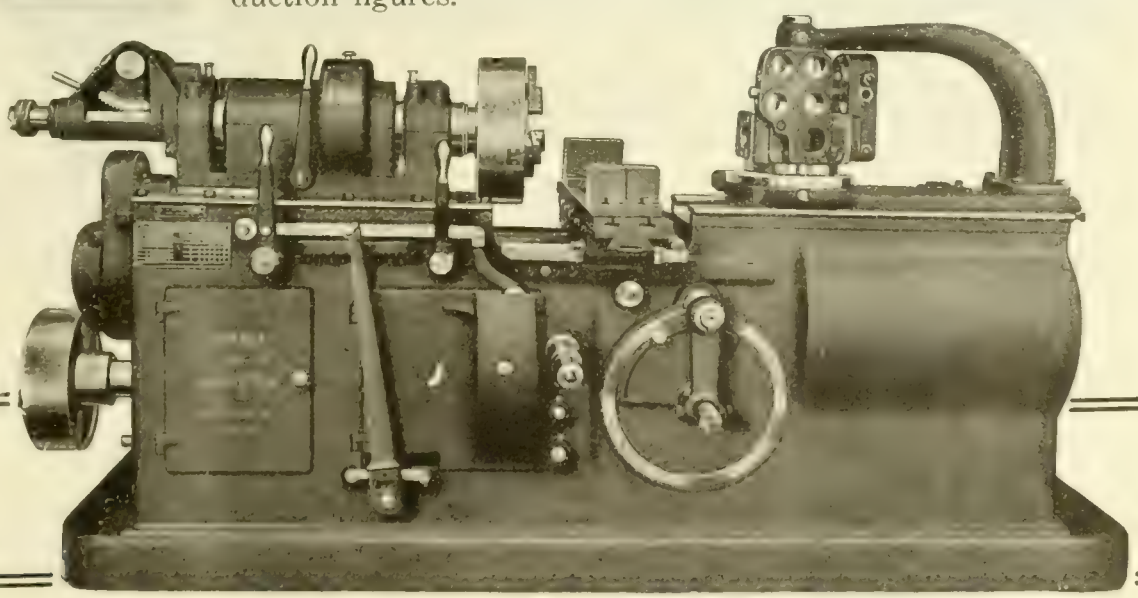
The Production of Pump Bodies

The production of Pump Bodies on the Potter & Johnston 6-A Automatic is an example of work worth while comparing with some of your parts.

Tools are set for Drilling, Counterboring, Turning, Facing and Threading.

The operator is attending to four machines, all of them engaged on work of this class.

No doubt you have work in your factory and it will pay you to send blueprints or samples along for production figures.



Canadian Offices : POTTER & JOHNSTON MACHINE CO.

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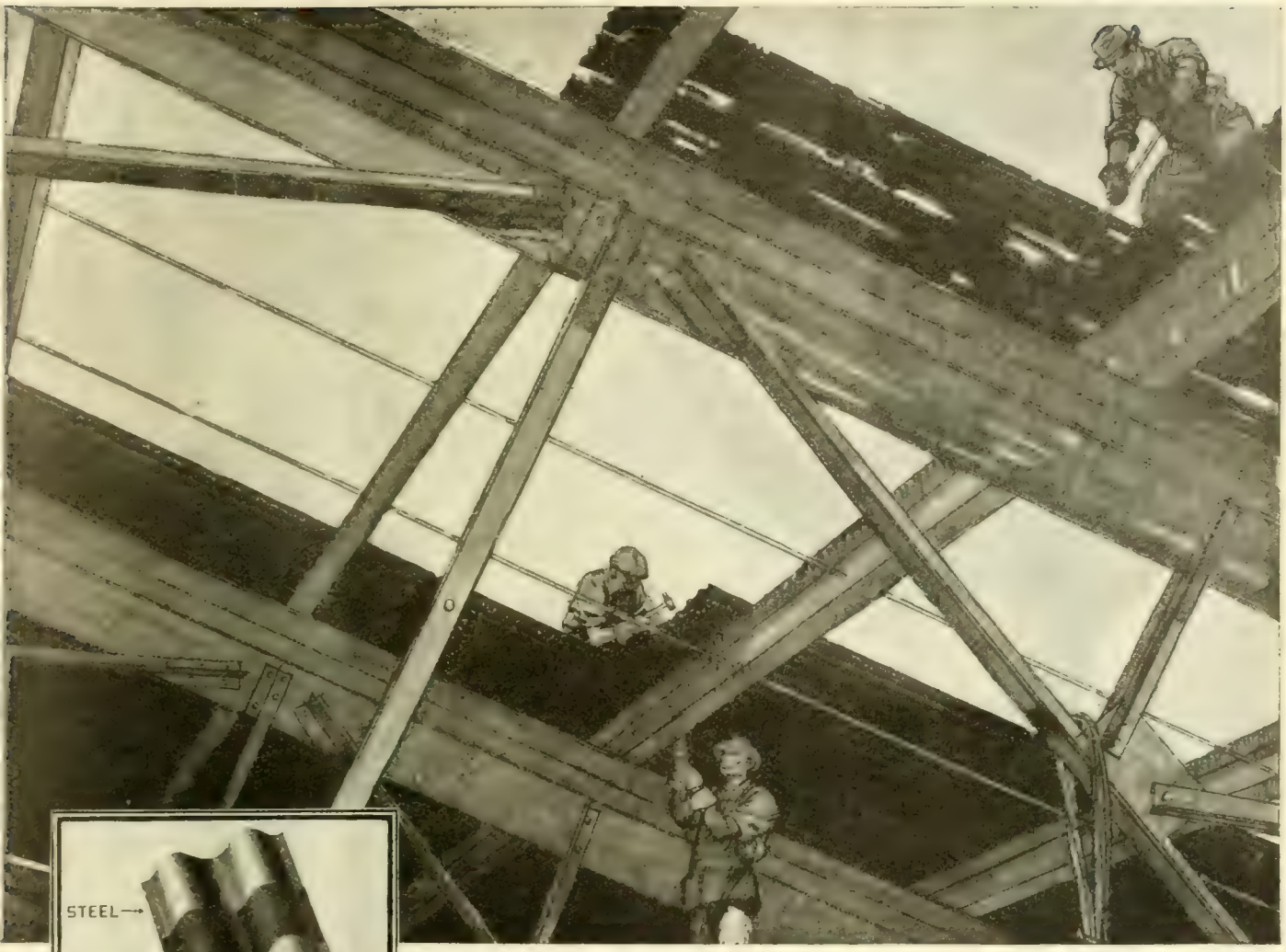

The three impervious coatings, illustrated above, over specially annealed steel afford protection against the corrosive effects of salt sea air, severe gases, strong acid and alkaline fumes and extreme weather conditions.

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Corrugated iron roofing and siding require frequent painting and repairs. The result is excessive maintenance costs. Robertson Process Metal, however, does NOT need frequent painting and repairs. Used for roofing, siding and other building purposes *in the first place*, it keeps *down* the cost of up-keep. Used for replacement, it provides insurance against future loss through premature depreciation, owing to its resistance to rust and corrosion.

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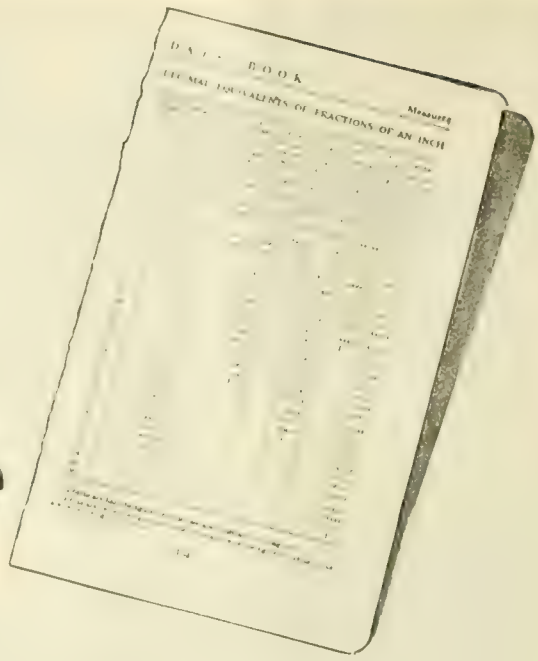
METAL FOR ROOFING AND SIDING



What's the decimal equivalent of 19/32nd's?

What is the breaking stress of No. 11 Roebling Wire?

How shall I select a bevel gear cutter for this work?

What clearance should I allow in grinding a milling cutter?

Answers to such common problems are found in the Starrett Data Book for Machinists.

Tables of decimal equivalents, machine screw dimensions, tapers and angles, wire gage standards — and hundreds of other facts in every-day use, are included in its 180 pages.

You'll find that it fits your job as it fits your tool kit. Its pocket size lets you keep it handy for ready reference. And there are mighty few problems that aren't answered in the Starrett Data Book.

At your hardware dealers. Also ask for Catalog No. 22 "3."

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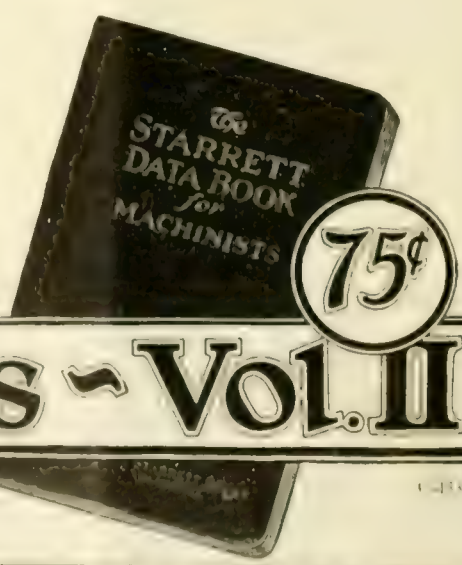

Starrett Books - Vol. II

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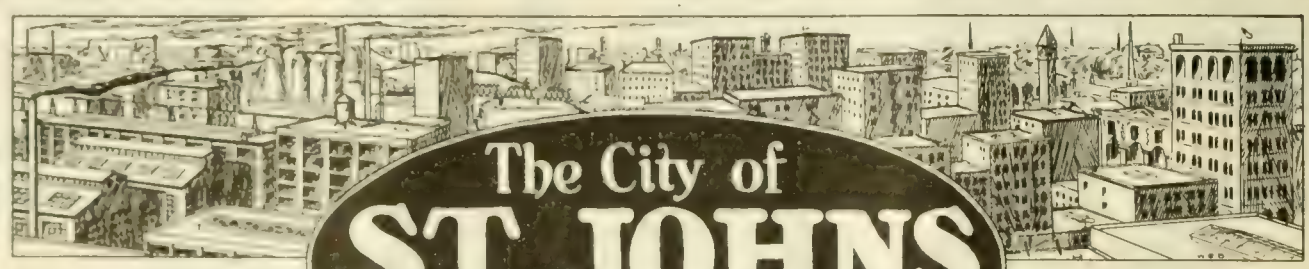

The City of
ST. JOHNS
QUEBEC

Locate in this Real Transportation Centre

St. Johns is a nerve centre of the network of railways connecting Central and Western Canada with the Maritime Provinces and with the Eastern States. Seven railways, including the C.P.R. and G.T.R., run through the city and are interconnected in the St. Johns yards by a terminal switching company. The manufacturer locating in St. Johns enjoys the advantages of competitive freight rates and dispatch in the assembling of raw materials and distribution of the finished product. The city in fact commands lower freight rates and a cheaper coal supply than any other centrally located manufacturing city on the North American continent.

St. Johns is directly connected by rail with the Montreal docks, 27 miles distant, affording first-class facilities for foreign trade. The city is an ideal location for the American manufacturer opening a branch plant in Canada; having direct connections by water with New York, the St. Lawrence and Great Lakes and the Eastern Seaboard of the United States.

Unlimited electric power is developed at Chambly, eleven miles north-east of the city, and distributed at prices that will compete with any city or town in the Dominion.

Cheap living conditions and low rents and taxes have resulted in cheap labor and an abundant supply of both skilled and unskilled workers is always available. Labor troubles are quite unknown.

In addition to the natural advantages of St. Johns as an industrial site the city also offers extraordinary inducements, such as: Tax exemptions; street extensions; bonus of five per cent. on your payroll for five years, making it an unusual industrial opportunity.

For more specific information write

The Secretary, City Council
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Without a knowledge of your business or the conditions affecting it, we do not claim that St. Johns is rationally your location; but we know that St. Johns possesses extraordinary advantages, that in all probability it is the best site for your plant from every point of view, that you will be running the risk of serious mistake if you do not include this city in your investigations.

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The result is rapid production with exactness.

ALUNDUM wheels have been proving their excellence on these many operations. For grinding caterpillar links of manganese steel regular [illegible] 24×2, ¾ inch taper per foot both sides, grain 10 grade T, have done remarkable work.

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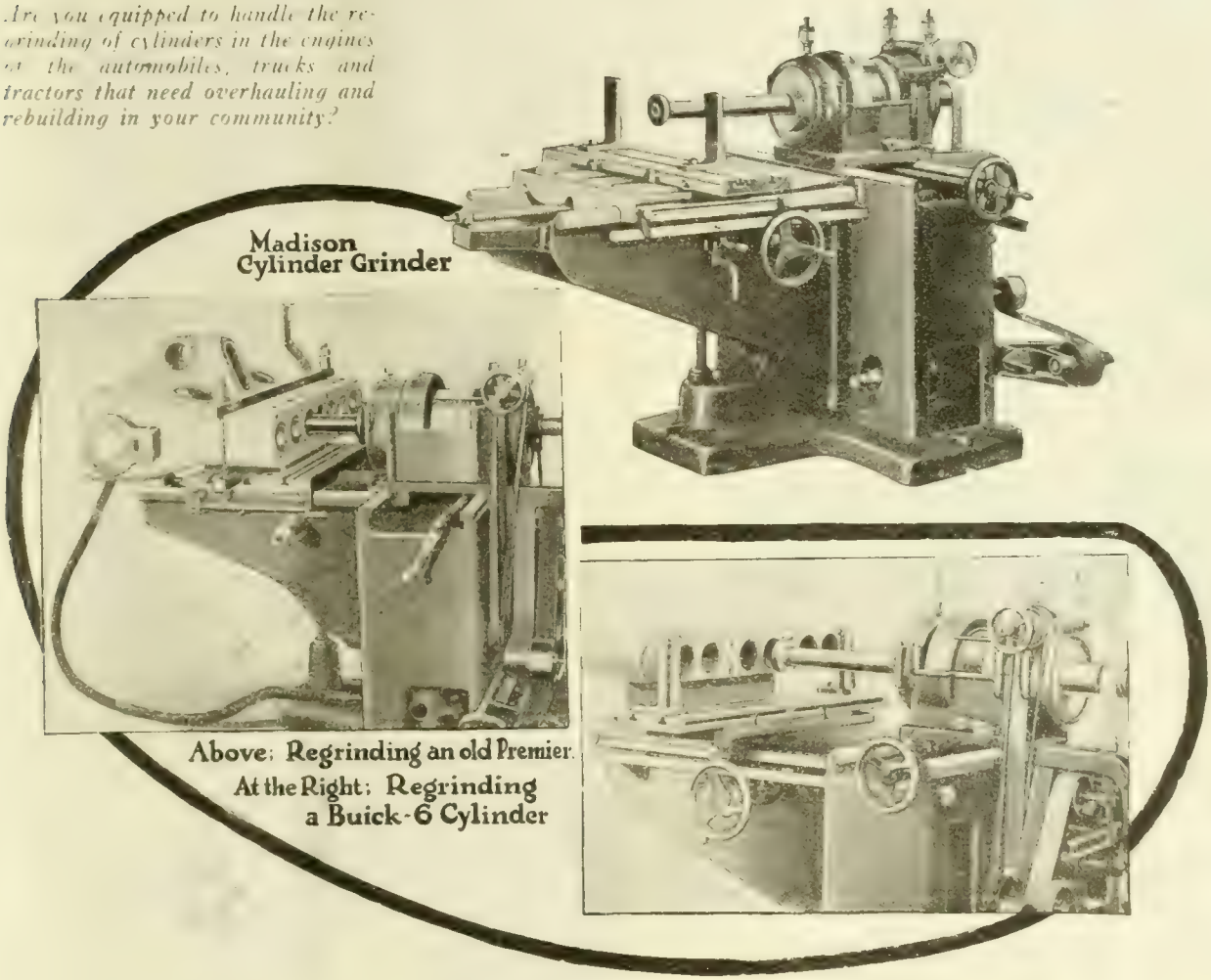
Are you equipped to handle the re-grinding of cylinders in the engines of the automobiles, trucks and tractors that need overhauling and rebuilding in your community?



Madison Cylinder Grinder

Above: Regrinding an old Premier.
At the Right: Regrinding a Buick-6 Cylinder

Add the profit of cylinder grinding to your automobile repairing and not only increase your profits considerably but make your customers boosters for you by putting power and life into their cars.

Put a Madison Cylinder Grinding Machine to work for you and do the gas engine cylinder re-grinding for all the repair shops in your vicinity.

Ask for the circular describing this machine—it will be sent you by return mail.

MADISON MACHINE TOOL COMPANY

1245 East Washington Avenue, Madison, Wisconsin, U. S. A.

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THE Canadian Fairbanks-Morse Company Limited reaches out to you through its sales houses and offers the service and satisfaction that is assured by its 100% standard of quality and service.
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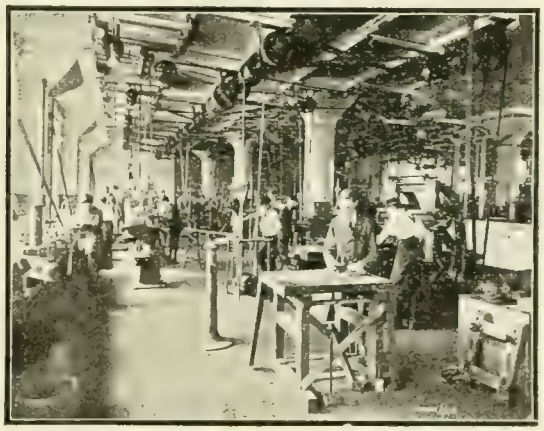
CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXV. No. 2 January 13, 1921

Training the Machinist of the Future

Practical jobs are tackled, not mere display parts. Outside work is often accomplished, and a small bench miller and several drill presses have been made by the students.

By J. H. MOORE



A PARTIAL VIEW OF MACHINE SHOP.

WHERE will the machinists of the next ten or twenty years come from? Were we to say "from the schools," that would hardly be correct, but if we say, "a great percentage will come from our technical schools," we would be on safe ground. There is, unfortunately, a popular misunderstanding as to the character of technical education. Some think of it merely as training of the hand and that such a school is a good place to send a backward child to. This is an erroneous impression, for the technical school is no dumping ground for stupid children. A walk through any technical school will convince the most skeptical on this point. Here will be seen clear-eyed, keen-witted boys, men in the making, boys who have decided on this method of developing their ability for the particular trade they desire.

A certain amount of book work is required of all pupils preparing for trades. No one can be a skilful worker in any trade without some instruction in mathematics and elementary science, therefore stupid children, or shall we say, backward children, would not make good at such a school. First, they must have planted in them the elementary seeds of knowledge.

Realizing the splendid work such schools are doing throughout the country, Canadian Machinery decided to study first hand one of these institutions. The Hamilton Technical & Art School was visited, and the story to follow will describe the conditions found there, touching especially on the machine shop and kindred trades, as it is in these we are most interested.

The present factory unit of this school was erected in 1918-1919, and was occupied for the organization of classes in September, 1919. Previous to that date, the school was run on a much smaller scale, and in a different part of the city. The demand, however, for technical education became so great that a six-foot plot was bought on Wentworth street, and the first unit erected. The building plan adopted provides for an extension to the present building that will cost in the neighborhood of $600,000. Even after this addition is made, the school will still have a very large athletic field for their students.

The number of pupils in attendance has increased amazingly during the last

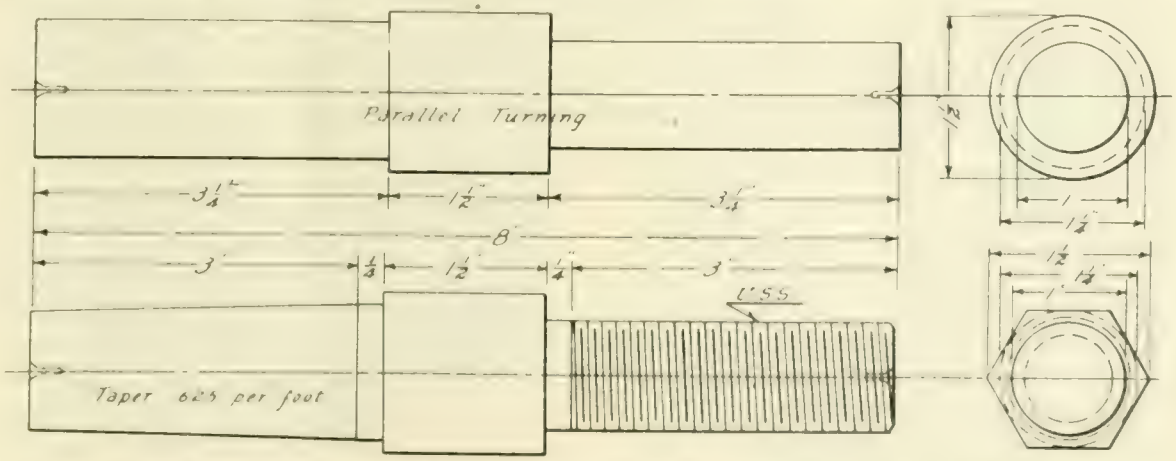


FIG. 1—THIS CAST IRON SPINDLE IS SPECIALLY DESIGNED TO EMBODY PRACTICAL OPERATIONS.

A PARTIAL VIEW OF PATTERN MAKING DEPARTMENT.

A CORNER OF THE ELECTRICAL DEPARTMENT.

four years. The attendance this year taxes the capacity of the present building, both in the day time and evening. During the day over 600 pupils attend, and in the evenings 5,407 students have enrolled. The records show that they have an average attendance every evening of 418. This figure was taken in October and has increased since then.

Subjects Taught

The evening classes cover over fifty courses of instruction, and a staff of over 80 teach 120 evening classes each week. Briefly, here are the subjects covered, these being subdivided into first, second and third year studies, if deemed advisable:

Arithmetic, Telegraphy, Electricity, Pattern-making, General Woodworking, Cabinet Making, Advanced Carpentry, Stationary Engineering, Printing, Linotype Operation, Shop Sketching and Mathematics, Machine Drawing, both elementary and advanced; Architectural Drawing, Chemistry, Machine Shop Practice, Tool and Die Making, Oxy-Welding, Motor Mechanics, Applied Mechanics, Commercial French, Commercial Spanish, Structural Design, Cooking, Sheet Metal Drafting, Millinery, Plain Sewing, Dressmaking, Freehand Drawing, Lettering and Show Card Writing, Clay Modelling, China Painting and Design, Perspective Drawing and Water and Oil Painting.

Day Courses

The day courses are naturally wider in scope, as the pupil has more time to study the various subjects. The course in which we are interested is the general industrial course, covering four years. Pupils of the junior fourth book standing in the public schools are admitted to this course, the second year of which leads to high school entrance standing. Upon completing the second year pupils have the option of continuing the industrial course, with special trade training, or of entering the technical high school course.

The first two years of this course not only prepares the student for entrance standing, but at the same time offers opportunity for training in carpentry, cabinet making, pattern making, machine operation, tool and die making, practical electrical work, motor mechanics, electro-plating, printing, mechanical and architectural drawing, and machine shop practice.

The work accomplished at this school is of an extremely practical nature. During 1919-1920, forty pupils were placed as apprentices to various trades. Twenty concerns in the city send their apprentices for a certain length of time each week, so that they can, through technical training, eventually become more valuable men.

We will not go into detail on the other subjects being taught, as after all, the machine shop is what we are chiefly interested in.

The Machine Shop

Keeping in mind that each student attends school from 9 a.m. to 12 a.m. and from 1.30 p.m. to 4.30 p.m., let us see how he spends his time. Owing to the number of subjects he must cover, his work is subdivided into short periods on each subject. The schedule is so arranged that in addition to covering all the academic subjects, he spends 1½ hours each week in each of the trade rooms, such as printing, electrical, drafting room, machine shop, etc. In this way every student has a chance of covering the various trades. This arrangement goes on for two years, when the student must then make up his mind to specialize in some particular trade, or proceed with the high school course, if he is desirous of going to the university, rather than following a trade.

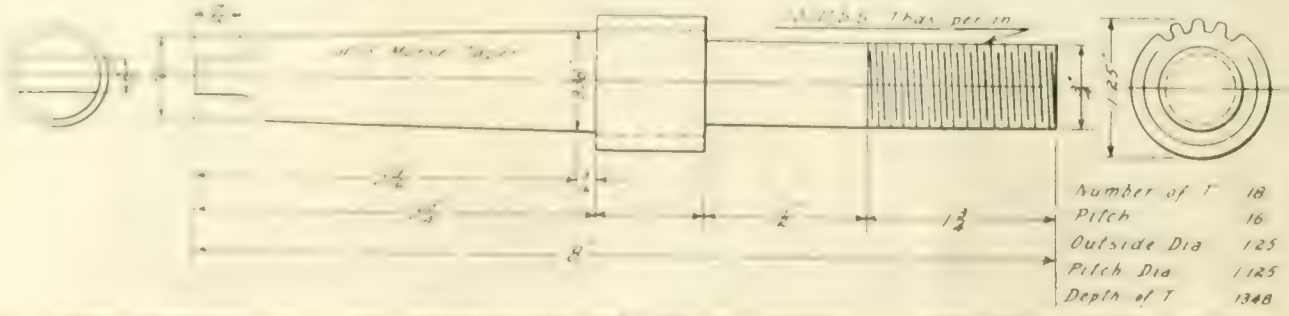
The First Year's Work

The method of procedure was thoroughly discussed by the author and head instructor, F. H. Kirkpatrick, and, in as far as possible, the following subjects are covered in the first year:

Bench work is subdivided into six sections, hammer and chisel, files, stamps, centering, calipers and hacksaw. The drill press work covers two divisions, first, drilling holes under ½" diameter, and second, countersinking holes for wood screws. In the first year work all speeds and feeds are adjusted by the instructor in charge.

Next comes the lathe. This is divided into five subjects, viz., facing, chamfering, straight turning, roughing cuts, taper turning, and simple thread cutting.

The milling machine work is divided into three sections, viz., plain milling, using the vise; plain milling, using the centres, and simple indexing. Shaper work is classed in two sections, surfac-



THE FIRST MAKE THE PIECE TO CONFORM WITH THE DIMENSIONS SHOWN

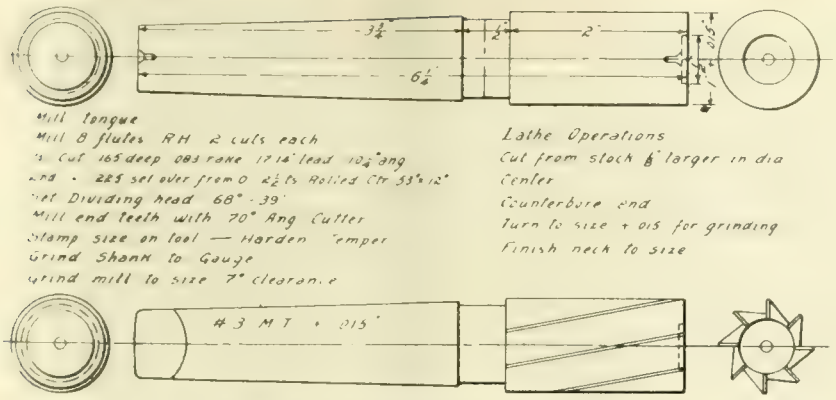


FIG. 4—HERE WE SEE THE VARIOUS INSTRUCTIONS ON THE MAKING OF A 1" SPIRAL END MILL.

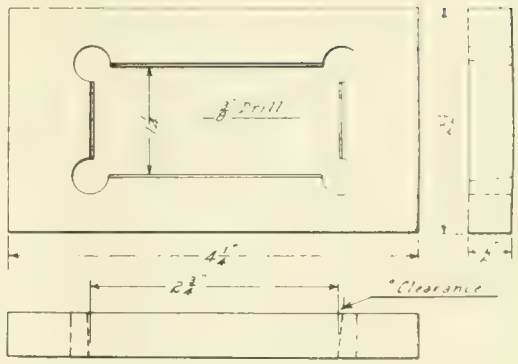


FIG. 3—THIS PAGE FORM BLOCK GIVES THE STUDENT LOTS OF PRACTICAL WORK.

ing (roughing cut), and surfacing to a finished cut.

Second Year Work

In second year subjects a review of the first year studies is always given. After this is completed the following further steps are taken. On bench work the student receives instruction on lay-outs, scraping, grinding drills, how to use a speed indicator, and determine his various speeds.

The drill press work is carried on up to holes 1¼" diameter, this meaning that they have to lay out the holes, watching their pop marks. The holes must be accurately drilled, and close check is kept on the students to see they have the right use of the chisel in correcting holes which are inclined to run. After the drilling come lessons in reaming.

The lathe work deals with parting, turning for drive, shrink and running fits, chuckwork, and crowning. Further instruction on the miller is given, this including the uses of the endmill, and problems in spur gear cutting. The shaper work is also advanced, parting, end cutting and down cutting being performed. These subjects are taken up, in addition to the review of the first year's work as already mentioned.

Third Year Work

Taking it for granted that the student has now decided to follow up the machine tool trade, he is allowed to specialize on this trade, devoting more time to it, and eliminating from his studies such trades as printing, etc. In all third year work a review of both first and second year is given.

The bench work goes still further into detail. The uses of taps and dies are found by actual experience. Hand-reaming, elementary die work, hardening and tempering are next taken up.

On the drill press lessons are given on boring, using the boring bar and power feeds. Next comes counterboring, drilling to a layout, also cylindrical work.

The lathe work receives careful attention, the student being trained to turn correctly to shoulders, taper turning to gauges, turning, using the steady rest, cutting multiple threads, and all conditions of chuckwork such as boring, reaming, taper boring and inside thread cutting. Next comes knurling and eccentric turning.

Milling machine work advances very rapidly in this year, rack cutting, milling tee slots, cutting bevel gears, cam cutting, spiral cutting, and the cutting of worm gears being done. On the shaper the student learns to cut keyways and all types of angles. The fourth and last year he advances still further into machine shop practice, even to the building of bench milling machines, hand punch presses and drill presses. The tools are by no means models. They are practical machine tools made from proven designs and in fact are marketed by the school. Ten drill presses have so far been sold and are in use in various machine shops, proving very satisfactory.

Practical Work

From the drop of the hat, so to speak, the student is taught to work on practical pieces, not display parts. Every job he performs contains real lessons in machine shop work. He is never wasting his time, for the course has been mapped out by practical men, who have passed through the mill themselves.

It is a great feeling to find that theory is given second place, and that practice with a capital P is given the seat of honor. As the instructor put it, "Boys are a peculiar problem. They must have something of real interest to them, yet you must not step them up too quickly if you want to make real tradesmen of them. We have no hard and fast rule regarding how fast a boy may advance. It is strictly up to the boy himself. We have a standard course. It's up to the boy to get through the course as promptly and efficiently as he can."

The Use of Tables

It has been found to be splendid policy to provide students with tables for

GENERAL VIEW OF CHEMICAL LA-
TORY.

THE BOYS DELVE INTO THE ART OF PRINT-
ING IN THIS DEPARTMENT

their use, these sometimes taking the shape of blueprints, while in other cases they are printed in their own printing shop. These tables include such subjects as reading the micrometer, allowance for running and force fits, points for twist drill users, cutting speeds for high speed steel, laying out angles, turning tapers, operating an engine lathe, and so on. These tables are printed on good stock, and made of a standard size, suitable for filing. The boys take advantage of this fact on many occasions and always have at a moment's notice a set of handy references.

Before leaving the subject of the table form of instruction, let us quote a portion of what the table entitled "operating an engine lathe" has to say: "An engine lathe," says the pamphlet, "is an ordinary form of lathe fitted with a lead screw and power feed." The student is then asked to locate the following parts:

Bed, headstock, tailstock, tailstock base, carriage, apron, saddle, compound rest, cross slide, tool post, lead screw, feed rod cone pulley, faceplate, headstock spindle, tailstock spindle, live centre, dead centre, back gear, driving gear, the ways, stud gear, reverse lever, feed rack, feed clutch and split nut lever. After the student has looked these parts over he should be well able to at least talk intelligently regarding the names of the parts. The other parts of the lathe, including chuck, rest, etc., are then discussed.

Next come the instructions, "Never make adjustments to the machine while running. Never tighten two clutches at once, such as the feed clutch and the split nut, which is used only when cutting a thread."

"Never lean against a machine while it is running. The hand may slip against a moving part and be injured, or the clothing may be caught.

"Oil every moving part daily. See that oil holes are not filled with dirt. Wipe off all excess oil. A well oiled machine indicates a careful mechanic."

The operator should now learn to operate first by hand and then automatically, the longitudinal and cross feeds, reversing each; how to use the back gears, leadscrew and compound rest; how to clamp tailstock and tailstock spindle; how to secure high and low speeds.

We will not go into any further detail regarding these instructions. Enough to say that all statements are simple, clear and concise. In fact, there are many truths included that tradesman could take to heart.

An Actual Job

Let us consider the cast iron spindle shown at Fig. 1. This spindle is so designed that the student who completes it successfully has mastered, in no small measure, the fundamental principles of lathe practice. He is given a blue print as shown, and proceeds as follows:

The piece is first centered, and a test made to see that centres are correct. The centre hole is next made on the drill press. Having proceeded thus far the piece is taken to the lathe and rough turned to 1-16" oversize. The ends are next faced to exact length, after which the shoulders are squared to length.

The next step is to rough and finish turn to blue print size. The taper is now turned on the end, this being done by the following process. The small end is turned to its proper diameter, after which the tailstock is set over enough to cut the desired taper. The formula, length of taper, multiplied by taper per foot is used. The thread is now cut on the front portion.

Next comes the milling of the hexagon, this being made to a special gauge nut. The six sides are milled, and the formula, 1.155 × flats=diameter, is used.

The Next Step

When the student has completed this part he, in a way, advances still further with the same piece. Fig. 2 illustrates what he does in this case.

He rough and finish turns to the smaller sizes shown, also squaring the different shoulders to the blue print size. He next turns the No. 3 Morse taper to a gauge, using the following formula:

$$\frac{\sqrt{\text{of W}} \times \text{T per ft.}}{2} = \text{S. O.}$$

After this is completed he proceeds

TEN SAFETY COMMANDMENTS

1. Thou shalt have no thoughts other than thy work.
2. Thou shalt take no unnecessary risks nor try to show off nor play practical jokes, for by thy carelessness thou mayest do injury which will have effect upon the third or fourth generation.
3. Thou shalt not swear nor lose thy temper, when things do not come just right.
4. Thou shalt not clean machinery while it is in motion.
5. Remember that thou art not the only one on the job and that other lives are just as important as thine own.
6. Honor thy job as thyself, that thy days may be long in employment.
7. Thou shalt not watch thy neighbor's work, but attend to thine own.
8. Thou shalt not let the sleeves of thy shirt hang loose nor the flaps of thy coat unbuttoned, as they may get caught in the machinery.
9. Thou shalt not throw matches [illegible] nor scatter oil around bearings, as a dirty worker is also a slimy worker and a slimy worker is a menace to his fellow workers.
10. Thou shalt not interfere with the [illegible] nor the engines, nor anything else that thou art told is dangerous.

[illegible] carefully.

[illegible]

POINTS FOR TWIST DRILL USERS

If the drill chips on the edge it indicates that the lip clearance is too great and fails to support the cutting edge. This may be because the drill is too hard. It is advisable to ease off on the feed and watch the grinding.

If it splits in the web, it is either ground with improper centre lip angle or the feed is altogether too heavy. The centre lip should be at about 45 degrees to the cutting lips of the drill. The drill is in best condition when the chip comes out in a close coil.

If the outer corners wear it shows that the speed is too high and it should be reduced. This is particularly noticeable in drilling cast iron.

Drilling cast iron can be done at a little faster speed than for steel, but the corners must be watched.

ALLOWANCES FOR RUNNING AND FORCE FITS

RUNNING FITS		FORCE FITS	
Diam. of Bearing	Diam. of Shaft	Diam of Hole	Diam. of Shaft
1	.999	1	1.001
2	1.998	2	2.003
3	2.997	3	3.005
4	3.9965	4	4.006
5	4.9963	5	5.007
6	5.996	6	6.008
7	6.9958	7	7.0085
8	7.9958	8	8.009
9	8.9957	9	9.01
10	9.9956	10	10.0105
11	10.9955	11	11.011
12	11.9954	12	12.0115
13	12.9953	13	13.012
14	13.9952	14	14.013
15	14.9951	15	15.014
16	15.995	16	16.0145
17	16.9949	17	17.015
18	17.9948	18	18.0155
19	18.9947	19	19.016
20	19.9945	20	20.017

Allowances for Drive Fits are one-half that of Force Fits.

to cut the thread. The last step is the cutting of the teeth on the centre portion of the spindle. From the foregoing description it will be noted that the student has received real practical tuition during the making of this piece.

Another Example

Another good example of work is that shown at Fig. 3. This, on the face of it, looks like a very simple proposition, but note the various fundamental principles involved as the operations proceed. This piece is what is known as a 16-page form block, and is used in the printing department of the school for tuition purposes. Thus a double purpose is served, viz., a good practical job, that can be used elsewhere.

This piece starts off on the shaper, and the top surface is rough cut, also the edges. The next step is to rough and finish the bottom surface, after which the top surface receives a finish cut.

The piece is now taken to the milling machine, where the edges are milled parallel, and to the blue print size. Special care is taken to see that the edges are square with the face of the block. One end is now milled square to the faces and the edges.

Bench Work

The block is next taken to the bench, where it is marked off by means of the square, scale and scriber. The end is now chipped by hammer and chisel to within 1-64″ of the marked line. It is next filed to the line, making sure the filed surface is square with the faces and edges.

TURNING TAPERS BY SETTING OVER THE TAIL STOCK

Tapers are usually given in "inches per foot" and include the total taper or difference in diameters unless otherwise noted. In turning tapers in the lathe it is necessary to consider the total length of the bar, whether the taper extends the whole distance or not, and to set the tail stock over just as though the taper extended the whole length.

If the taper is ¾ inch per foot as in pipe threads and the whole bar is 16 inches long, then the total taper is 1 inch and the tail stock must be set over ½ inch. There is nothing to remember except to set the tail stock over half the total amount if the whole bar was tapered at the same rate.

The top surface is now scraped, using a surface plate to ensure proper accuracy. The block is next laid out, and the centre located. To allow students to become familiar with the use of the surface gauge, this instrument, in conjunction with the surface plate, is used.

The rectangular form, as shown in sketch, is now laid out, the dividers, scale, scriber, square and hermaphrodite calipers being the tools used. The ⅜″ corner clearance holes are next laid out, also the ¼″ holes inside, and tangent to the rectangular layout, and tangent to one another.

Drill Press

The drill press is next used, when the ⅜″ and ¼″ holes are drilled. From here it goes back to the bench again and the webs are drifted out, and then the rough edge is chipped fine. Filing is next in order. First the edge of hole is rough filed, after which a smooth file is used to file to finish mark lines and square with the face. The last step is to file a one degree clearance on the edge of hole. A protractor is used to ensure accuracy.

It will be readily seen that this plan would not be adopted in an actual machine shop for the production of such pieces, but by arranging the steps in this manner the students get familiar with the use of the various tools, at the same time deriving considerable machine shop experience. No poor work is allowed to pass. For example, suppose a student is rather careless in the filing operation. Does he get away with it? Not much. He must start all over again and produce a block that is correct in every detail.

Making An End Mill

We could go on indefinitely, quoting examples of work done, but for the purposes of this article, will take up only one other job in detail. The sketch shown at Fig. 4 illustrates, in reduced form, the style of blue print used in the making of a 1″ spiral end mill. As will be noted, all instructions are contained on the blueprint. The student can, by this method, go right through the job, feeling confident he is pursuing the right tactics.

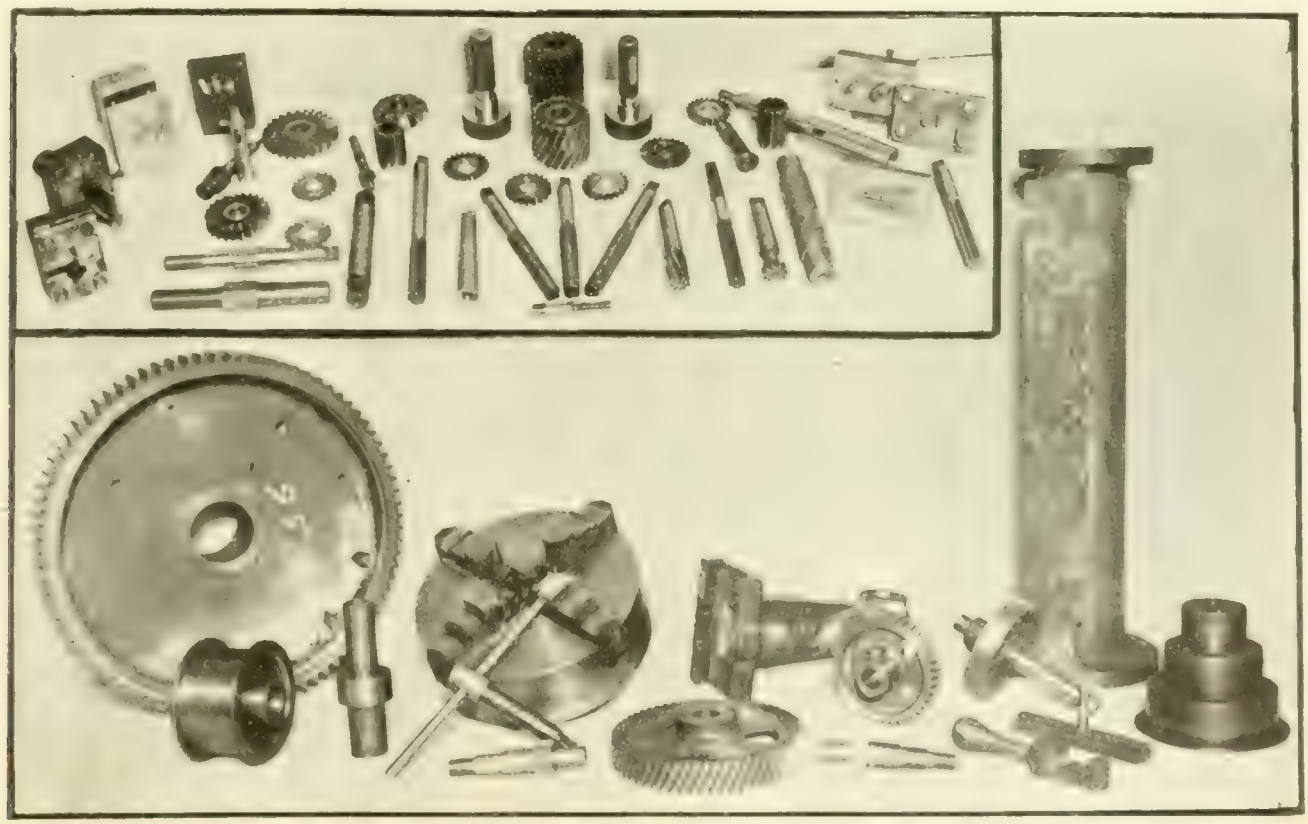


FIG. 5 LOWER VIEW SHOWING A VARIED ASSORTMENT OF WORK COMPLETED
FIG. 6 UPPER VIEW A MISCELLANEOUS GROUP OF SMALL TOOLS, SOCKETS, DIES, AS MADE BY THE BOYS

Examples of Finished Work

To illustrate the variety of work accomplished, let us refer to Fig. 5. Here are shown several articles, which have been completed by the students, some of which are what is termed outside work. By outside work we mean work completed for some outside firm. Many concerns take advantage of this chance, and send in work to be finished, paying the school for the same. In this way the school is partially self supporting. The chuck shown is only one of many that have been completed by the students, and the writer inspected the same and found it to be excellent workmanship.

One would hardly believe that such accurate work could be done by boys. The tall casting to the right of the photograph is part of the column for the drill press mentioned earlier in the article. The cutting of gear teeth is something in which the boys excel, and the four examples shown in the photograph bear out this assertion.

Fig. 6 depicts a few of the small tools, gauges and dies produced by the students. In this group is shown the spindle we already referred to in the first example of lathe work. Note the small, three section, armature field die in the background, also the key blank die to the right. A great majority of the cutters used by the students are made by themselves. This statement holds equally true regarding sockets, arbors, reamers, end mills, taps, gauges, form cutters, drills, etc. In other words, the idea behind the tuition is to make the students capable of producing almost any tool or fixture needed. Nothing is purchased outside, except absolutely necessary.

Die Press

Take for example Fig. 7. Here we see a die press, or in other words, a hand punch press. This machine was made by the boys themselves and is not a show machine by any means. The instructor can be seen in the foreground, while one of the full time boys (as he is called) is shown in the background. While on the subject of this young fellow, let us tell a little of his ambitions. The author purposely got him talking. "What's your idea in staying here all day long?" I asked. "In order to make myself a real mechanic," came back the reply. "Before coming here I was apprentice at ——— plant, but could not get the chance I wanted, so I saved up my money with the object in mind of coming here as soon as I had sufficient to keep me. As soon as I had enough I came here, and since that time I've had a real chance. I work on every machine in the department, get the best of instruction, and hope to be a real mechanic in the near future."

Judging from the way he spoke, and his confident bearing, I think he'll get his wish. When I was interviewing him I noted he was working on a special die for an outside concern. This die was by no means simple, but our young friend was getting along admirably.

Equipment Used

The very nature of the work performed speaks well for the equipment used. The very latest machine tools are in evidence. The lathes are of the modern type, the planers and shapers of the best obtainable design, in fact every machine tool is a late model. The boys are not asked to perform wonders on some old machine that probably came from the ark, but get even better machines to work on than they might get at first, if learning their trade elsewhere. The line shafting is cleverly arranged, being driven by three separate motors, thus allowing the running of only such machines as necessary.

Examples of Tables

To illustrate a few of the tables used for instruction purposes, let us refer to Figs. 8, 9 and 10. No. 8 describes all that is essential, while No. 9 is a very handy table for reference purposes. No. 10 soon tells the student the causes of poor drilling. Fig. 11 is nothing more or less than a warning notice, yet is gotten up in a nice style to attract the boys' attention. The remaining views of the school are simply general views taken for the purpose of showing a few of the trade departments.

"What do you think of the future for these boys?" I asked. The reply was not long in coming. "To my mind," said the head instructor, "we give a boy a training equal to any machine shop. It is of course up to the lad himself, but providing he has followed up our course from beginning to end, in an earnest manner, there is no reason why he should not become an excellent mechanic. You know," he concluded humorously, "we need good mechanics," and I agreed with him.

GIANT ELECTRIC POWER STATION

The new electric power station at Glasgow, Scotland, takes rank as one of the largest in the country. It is designed for an ultimate capacity of over a quarter of a million horse power, and each generating unit—of which there are five in the first half of the station recently completed—will be of 24,000 horsepower. Each boiler is capable of producing 62,000 pounds of steam in an hour. All the latest labor-saving devices for loading coal into the bunkers, stoking the furnaces, and removing the ashes are installed, and a very high degree of economy in the production of electricity on a large scale is assured.

NEW HOIST CATALOGUE

The Wright Manufacturing Company, of Lisbon, Ohio., manufacturers of high-speed hoists, screws and differential blocks, and steel trolleys, have just issued an attractive new catalogue descriptive of their line. It contains much data of use to those interested in hoists and a portion of the catalogue is devoted to a discussion of the various types of hoists and the field of usefulness of each.

Interest in Your Work an Absolute Necessity

By G. L. SPRAGUE, Principal Hamilton Technical School

MODERN manufacturing methods have broken down standards in the machinist trades. Only in the tool room and repair departments are found men who could classify as all-round machinists. The rank and file of men operating machines in what is known as the metal trades are merely machine tenders, operators, and specialists, according to the mastery they possess in producing on some particular machine.

Increasing subdivision of labor in modern industry is responsible for this breaking down of trade standards. Manufacturing methods of today tend largely toward mass production. The output of the individual is only a part of the whole. His contribution is merged into that of the mass. His daily output travels to the assembling or fitting-up department. What the individual creates out of raw material rarely shows up before him as a finished product.

Effect of Mass Production

The effect of mass production upon the individual is both mental and economic. On the psychological side his mind is dulled by montonous repetition of a limited performance of tasks. His mental capacity is not taxed, his initiative remains undeveloped, and he slumps into a condition of ambitionless effort. He goes to his day's work because it is necessary for him to earn the wherewithal to live and maintain those dependent upon him. As far as interest in his work is concerned, there is little to appeal to the average worker of this class. Work should be varied, should test a man's capacity for performance to enlist his interest. Men who have such work to do never suffer from labor unrest. Work to them is a natural function in which they find satisfaction and happiness. Economically, workers of this class are limited to opportunity for employment. They constitute the floating labor of to-day. They are not skilled, and they are not unskilled.

What Can Be Done?

The problem is, what can, and what should be done, to revolutionize modern manufacturing methods, so that not only the physical, but also the mental capacity of men may contribute in the largest degree to industrial prosperity, and to the economic independence of workers.

To my mind apprenticeship should be established upon a modern basis. A term of four years in the machinist trade is sufficient to train young men in various operations and processes of the trade. Wages should be adequate to enable young men to live. They should be adjusted on a scale increasing every six months during the apprenticeship period, with a bonus granted upon the satisfactory completion of the course. Employers should keep faith with apprentices and assure them real training in all branches of the trade, not simply use them as cheap labor. For this purpose, in large plants apprentice shop instructors should be employed to change apprentices progressively from one class of work and machines to another. Instruction should be given one, or two half days each week in related mathematics and drawing, so that apprentices may master shop calculations and understand blue prints, also be able to make intelligible sketches of machines and machine parts. From apprentices so trained, employers could recruit efficient leaders in production.

The second step that is practicable, and should be attempted, is to establish a training department in machine operation in every large manufacturing plant. At the present time, breaking in of new men is left to the foreman, with a resultant increased scrap heap. How much the scrap heap costs modern manufacturing concerns, only their cost accounting systems will show. The cost of this scrap heap can be reduced, both to the good of modern industrial enterprises and the workers.

How is it now? A man wants a job. He applies for work, is asked if he can run a milling machine. He picked up what he could in odd moments from the other man about running a milling machine. Consequently, when in quest of work and the opening comes, he makes a bluff at running a milling machine. The foreman discovers that he is bluffing when some of his work is marked for the scrap heap.

Why should not large manufacturing plants have a shop fitted with machinery for training men, later turning them into the shops for more important work? Intensive training methods could be adopted which would provide the necessary supply.

Rotation of Tasks

If apprenticeship training is seriously undertaken, and the special suggested training department put into operation, it would be possible in time to establish a rotation of tasks. This would give men that diversity which is the spice of life, an important factor psychologically in promoting satisfaction with work. By a gradual process of transfer from one class of work to another, output would not be seriously decreased, nor production costs increased.

G. L. SPRAGUE

THE students of the Hamilton Technical School are fortunate in having for their principal a man of such wide experience as Mr. Sprague. Previous to guiding the destinies of the youth of Hamilton he held the following positions:

He was general superintendent of apprentices for the American Locomotive Company, and was on the staff of the Vice-President of Manufacturing and Engineering. He organized the shop apprenticeship system of that company in 1910 for seven different plants.

He also held the position of efficiency engineer of the State Board of Public Affairs, Madison, Wisconsin, and made investigation of all departments of the State in 1912.

While in Madison he acted as assistant to State Board of Industrial Education and helped develop Continuation Schools in various cities. He also was superintendent of A. E. Norton Company Structural Steel Plant, Boonton, N.J.

From there he went to be special agent for the U.S. Commission on Industrial Relations at Washington, D.C., and acted as expert on industrial education and administration of child labor laws.

He was next executive secretary of the Public Education and Child Labor Association of Pennsylvania with office in Philadelphia. One year after accepting the above position, he came to Canada to take charge of the development of technical education in Hamilton, August, 1916. Since that time he has built the school to a point of high efficiency.

Increasing the Capacity of Old Locomotives

The Rebuilding of Old Type Locomotives—Points to Watch—How to Change Wheel Arrangement—Locomotives Having Outside Valve Gears Have Capacity and Economy Increased

By C. B. SMITH

IN these days of the high cost of railroading, responsible officers of the mechanical departments realize that the necessity for reducing the cost of all locomotive operation and maintenance is more urgent than ever. Such saving can be accomplished in two ways, one by using new and modern locomotives, the other by rebuilding old types.

The purchase of new locomotives is usually confined to the largest units permissible for each type required, and they are equipped with superheaters and other modern devices as selected by the purchaser. Older engines of modern type, but not originally supplied with superheaters, are also being so equipped at general shoppings of these engines on the greater number of the roads of the country, and as rapidly as local conditions will permit. This improvement brings the older locomotives up to the capacity of those more recently purchased, and such reconstruction will undoubtedly be continued until all such locomotives have been modernized. The wisdom and economy of this work are known to all.

On the majority of our roads there are still locomotives of the earlier modern types whose general features of construction are satisfactory, and which only require modernizing to make them economical transportation units. Improvements for such classes of locomotives may include, in addition to superheaters, piston valves in place of slide valves, outside valve gears in place of Stephenson motion, and such other improvements as are usually made upon engines at general shoppings.

A Problem

The replacement or betterment of the older locomotives "in kind" is becoming more of a problem where suburban and local passenger service and branch-line traffic still require the maintenance of the lighter types of locomotives that can handle such traffic. Such engines are periodically returned to the shops for repairs, and the frequency of these shoppings could be reduced and mileage between them increased if the time were taken at one shopping to modernize them. Extensive reconstruction, however, requires a longer shopping period and reduces the number of engines available for road service.

In an excellent paper presented at the Convention of the American Railroad Association last June, G. M. Basford convincingly sets forth the present situation of the railroads. His paper furnishes a strong incentive for making a close analysis of the conditions of our roads, and developing the greatest program that can possibly be carried out in rehabilitating existing locomotives.

Items which are to be considered in any program for increasing locomotive capacity are:

1. Superheater.
2. Pyrometers.
3. Brick arch.
4. Valve motion.
5. Mechanical stoker.
6. Power reverse gear.
7. Automatic fire door.
8. Feedwater heater.
9. Improvements in boiler design when new boilers are required.
10. Improved boiler circulation.
11. Increasing firebox heating surface.
12. Flexible staybolts — breakage zones.
13. Covering steam pipes.
14. Flange oilers.
15. Automatic driving-box wedges on heavy locomotives.
16. Steam-pipe joints at smokebox.
17. Pneumatic bellringer.
18. Chime whistle on freight — more audible to train crew.

These items are numbered for convenient reference and do not necessarily indicate the order of importance.

Factors which will increase the capacity of a locomotive may do so directly or indirectly, singly or in connection with others. When setting out to rebuild a locomotive the experienced supervisor appreciates the opportunity to apply many devices and facilities which will standardize the engine in accordance with the railroad company's practice, and in so doing reduce repairs and stores department expense in maintenance.

The aggregate of such improvements results in a locomotive which in proportion to its capacity will produce service results comparable with those of entirely modern construction, and at a cost approximately one-half that for a new locomtive of similar capacity. The difficulty in carrying forward an extensive reconstruction program, however, is in finding the shop facilities either on the railroad or among the locomotive builders in order to advance the work at a satisfactory rate of progress. Nevertheless, despite this difficulty the results which could be obtained from the operation of reconstructed locomotives, if they could all be rebuilt within the next few years, would than three years to complete the work, it would seem necessary to arrange for enlargement of shop facilities in order to hasten the reconstruction. If, however, adequate shopping facilities are not forthcoming, the improvement program for locomotives must be confined chiefly to the application of superheaters and the substitution of piston for side valves; together with the minor but relatively important betterments that may usually be applied at the shopping period. On some roads this work alone will require six years at the present rate to equip what can rightly be called the "early-modern" locomotives.

Some of the engines built within the past ten years have developed weaknesses in frames and in parts of running gear. It has proved justifiable to reconstruct them by substituting new parts of stronger design and thus avoid recurring breakages which interrupt both the road service of these engines and the repairs to others. On roads whose traffic and service conditions now demand and will continue to demand the use of light locomotives for passenger trains and freight trains on branch lines, the better classes of the light locomotives should also receive their share of improvements along with the heavier power.

Old locomotives requiring new boilers have very generally been scrapped, but where light train service demands no heavier engines than formerly, the writer believes it advisable to rebuild such engines with radial-stay boilers, superheaters, new piston-valve cylinders, main frames when necessary, and outside valve gears. If there is to be no increase in the boiler pressure over that formerly carried by the locomotive and the valve motion has given little trouble by breakages, the Stephenson motion may be connected to the piston valves through the usual rocker-shaft connections.

Changing the Type

Old locomotives that are unsatisfactory as to wheel arrangement may be rebuilt and changed to another type and service. One road has converted 2-8-0 type or Consolidation locomotives to 0-8-0 switching service by removing the leading truck, applying a new boiler, new cylinders, outside valve gear, power reverse gear, and modifying the frames as required. The boiler was located to properly balance the engine. The use of the running gear and many of the parts of the original locomotive doubtless justifies such extensive reconstruction work where additional switching locomotives are needed.

The old eight-wheeled, American-type locomotives having crown-bar boilers

(Continued on Page 44)

Fuels, Their Uses and Proper Application

Steel Cannot Be Successfully Treated in a Coal Forge—Properly Designed Furnace is Essential—Be Careful to Use Proper Type of Furnace—Select Your Fuel With Care

By W. A. EHLERS*, Industrial Engineer, American Gas Association, New York

THE science of metal treating is unquestionably one of the most interesting and important subjects in the mechanical field to-day, and one which calls for the most careful and comprehensive study and application if correct results are to be secured.

Metal treating has come into greater prominence in recent years, due in a large measure to the ever-increasing demand for lighter, yet stronger and more durable moving parts in all forms of machinery subjected to unusual wear or shock, and also on account of the great development in automatic and special machinery.

Unfortunately many shops are still treating tool steel in the old blacksmith forge, which is as much a relic of the "dark ages" as the ox cart is in the field of rapid transit. Steel cannot be successfully treated in the coal forge, due principally to the condition of uneven heating. Uneven heating produces uneven cooling, which in turn produces uneven stresses in the piece when it is quenched, and hence will shorten the life of the finished part.

A uniform temperature throughout the entire heated area is necessary if correct results are to be obtained. It is surprising to find that many practical steel treaters continue to use the old and crude method in treating expensive steel, because they do not see the wisdom of purchasing modern furnace equipment, which will give better results and greater economy by prolonging the usefulness of the tool.

It is of interest to note that many of the manufacturers of so-called "special steels" for tool making purposes recommend that they be heat treated in gas-fired furnaces.

Certain fundamental conditions enter into the processes of metal treating which are of great importance. One of these is the necessity for obtaining uniform results, and the elimination of the possibility of producing work below the required standard. To obtain uniform results it is very necessary to regulate and maintain the temperature of the furnace within a reasonable degree of that required for the particular operation. This imposes the condition that the fuel must be of such nature that the amount of heat delivered can be changed very quickly. It is also necessary to have positive control of the furnace atmosphere.

The ideal furnace is one which maintains an evenly distributed heat throughout the parts to be heated when loaded to its capacity, and one in which the temperature and combustion products are under positive control.

From chemistry we learn that matter may be defined as that which occupies space; that matter is composed of infinitely small particles known as molecules. Molecules are again composed of atoms, and these combine to form elements or compounds. Thus, like atoms will form an element, and when combined with atoms of other substances they form a compound.

It has also been proven by experience that the molecules of all matter are never at rest, but are always in motion and the motion of these molecules produces heat, therefore the greater the activity of the molecules, the greater will be the amount of heat produced, all other things remaining unchanged.

Moreover each combustible substance has a definite temperature of ignition and when certain of these molecules reach the temperature of ignition they have a great affinity for oxygen. The resulting chemical union between these atoms gives rise to what we term combustion. Combustion has therefore been defined as "the phenomena produced on the surface when two substances unite to give light and heat."

In a further study of combustion there are certain fundamental factors and conditions to be met if proper combustion is to be obtained and the resulting heat properly applied. All fuels are made up of combustible substances, each giving a certain definite temperature of ignition and each forming a new compound when mixed with the proper amount of oxygen at the point of ignition. This leads to the conclusion that perfect or complete combustion can take place only when these substances are mixed with oxygen in the proper proportion. Or, stated in more familiar terms, a definite amount of air is required to completely burn a given quantity of fuel.

The properly-designed furnace is an important factor in heat treating. Time will not permit me to go into this very important subject. Poorly designed furnaces are not only uneconomical but they are largely responsible for unsatisfactory results. Many furnaces are operated without knowledge of the composition of the furnace atmosphere; with no control of the air supply or flue gases. There are certain fundamental principles such as type of construction, kind of fuel and the means of utilizing the heat of combustion that govern the design, but in general the character of the work to be performed, the kind and quantity of materials to be treated are the controlling factors. The real test of a furnace for a given operation is "the variation in temperature in all parts of the furnace around the mass to be heated when the chamber is loaded to full capacity."

Type of Fuel Necessary

One of the first things to be considered in the proper heat treatment of metals is the kind of fuel necessary to produce the character of heat best suited for the particular operation. Unfortunately there is a prevailing belief among many that when it is desired to heat-treat a piece of steel the only thing necessary is to build a fire and plunge the material into it. If results are not forthcoming they blame the steel perhaps and not the method, which, in most instances, is the real cause.

For all practical purposes fuels may be classified into solid, liquid and gaseous. It must be remembered that in the case of solid and liquid fuels each must first be converted into gas before combustion really takes place, and for this reason they are not so easily adapted to exact furnace conditions and temperature control.

Of the solid fuels, coal and coke are principally used. Lump coal and coke are not very well suited for metal treating operations, except in very large furnaces for pack annealing and case hardening in large quantities. Even with these it is not easy to maintain a uniform temperature, and there is great danger of overheating. At best they are very wasteful of fuel, and it is difficult to control the products of combustion, which is particularly essential where the metal is subjected to the direct action of the flame.

Powdered coal has a great advantage over lump coal or coke in that it may be termed a "one stage" combustion, being complete and free from residual carbon. It burns directly to CO_2 without the attending losses of unburned carbon and carbon contained in the ash. Its chief advantage, however, lies in the mechanical preparation of it, as it must be crushed, thoroughly dried and stored, also in the harmful action of the ash upon furnace walls and linings.

Liquid fuels generally exist in the form of kerosene, gasoline, and fuel oil. Owing to the great demand for kerosene and gasolene for internal combustion engine and other purposes, their cost has advanced to such a point that they

*Presented before the American Society for Steel Treating.

cannot be considered for the heating of furnaces. Fuel oil as a general rule is more expensive to use than coal or coke, but its superiority of these fuels in its form of application to the furnace is sufficient to overcome the increased cost. Fuel oil is a by-product of crude oil refining, and its cheapness in the past has been due principally to crude methods in refining and an over production of crude oil. With the increasing demand for motor fuel, improvements have been made in refining methods, which have very materially reduced the fuel oil available for metallurgical purposes. This situation is largely responsible for the scarcity of fuel oil and the unprecedented high price, and according to reliable authority, including the U. S. Bureau of Mines, very little hope is given that it will be any cheaper for some time to come.

A good grade of fuel oil will range from 18,500 to 20,500 B.t.u.'s per pound, and a vaporizing point of about 170° F. Considering that air is composed of 20.7 parts oxygen and 79.3 parts nitrogen, one pound at 62° F. occupies a space of 13,141 cubic feet, and at 100° F. one pound occupies 14,096 cubic feet. Theoretically it requires about 14 pounds of air to give perfect combustion of one pound of oil. Therefore it will require 14×14.096 or 197.34 cubic feet of air to burn one pound of oil at 100° F. However, in practice it requires from 17 to 20 pounds of air, or in round figures 2,000 cubic feet of air at 100° F. to completely burn one gallon of fuel oil.

Oil Must be Atomized

In admitting oil to the combustion chamber of the furnace it must be broken up into a fine spray, commonly spoken of as atomized, by means of a suitable burner. Atomization may be obtained in one of three ways: Live steam, compressed air, and mechanical process. Of these compressed air is more generally used.

Where air is used for atomization it is usually found to vary in pressure from 1½ pounds to 60 pounds per square inch, depending upon the kind of burner used. The majority of installations work with an air pressure of about 20 pounds per square inch. This, however, is higher than necessary for good results. With air under pressure of 20 pounds per square in and oil at 100 F. there is required about 50 cubic feet of air per pound of oil.

[illegible] in many places it is [illegible] cers (August 1911 Bulletin) which give [illegible]

POINTS TO REMEMBER

Uneven heating produces uneven cooling. This in turn produces uneven stresses in the piece when quenched. Such procedure shortens the life of the piece.

Poorly designed furnaces are not only uneconomical, but are largely responsible for unsatisfactory results.

Powdered coal has a distinct advantage over lump coal or coke because it is free from residual carbon.

It requires 2,000 cubic feet of air at 100 degrees Fahr. to completely burn one gallon of fuel oil.

Fuel oil often contains a small percentage of water which lowers its heating value. For each one per cent. of water the heating value is reduced 13.14 B.t.u.'s Thus for an oil having nominally a heating value of 18,500 B.t.u.'s per pound and containing 10 per cent. water the heating value is reduced to 16,518 B.t.u.'s, or a loss of 1,982 B.t.u.'s. If water is in the oil, combustion is incomplete, the violet flame never appears, but the end of the flame will be dark red and fringed with smoke.

Fuel oil being rich in hydrocarbons gives a very high heat for a comparatively small volume of oil. For this reason it is particularly adaptable to heavy forging work such as drop forging, the heating of heavy bars and rods for forging and upsetting. It is also a very excellent fuel for welding.

But there are many things which must be considered before selecting oil as a fuel, particularly on the purely heat-treating operations. There is the necessity for a large and expensive storage tank which must be buried in the ground. This tank frequently leaks and much oil is wasted before the leak is discovered. Smoke, grease and the roar of burners under high pressure are serious objections, and these are not conducive to making the surroundings pleasant for the shop men.

Moreover the use of oil does not permit of automatic temperature control by placing a thermovalve in the fuel line. Conditions affecting a continuous supply are not the best, and frequently much time is lost waiting for a new supply.

Gases which are most generally used for fuel purposes are natural gas and the manufactured gases such as coal gas, coke oven gas, water gas and producer gas. These gases are preeminently suitable for and by far the most satisfactory fuel for metal treating processes. These facts combined with the economic advantage makes gas the coming fuel of the future.

Gaseous fuel is economical because it can be applied in a way most adaptable to the requirements of the material to [illegible]

must be burned in the furnace in a certain fixed way, there is very little flexibility in their application. Gas on the other hand can be applied in a way that will give the best results with the least waste of fuel.

By its nature and composition gas offers the greatest advantage from a purely scientific point of view. It is easy to thoroughly mix it with the proper amount of air for complete combustion. With other fuels this is impossible. Control of the air-gas ratio means a higher rate of combustion, a relatively higher flame temperature, and therefore a higher thermal efficiency.

The cheapest fuel, even with other things being equal, is not necessarily the one which gives the greatest number of B.t.u.'s per unit of cost, but the one which costs less per unit of production. Numerous examples can be given to prove this statement. However, one or two should be sufficient. In a certain town in the state of New York, gas selling at a rate of approximately one dollar per thousand cubic feet replaced soft coal at about five dollars per ton, for bright annealing copper wire. It was first demonstrated in an experimental way that coal was the most expensive fuel for this particular operation, although it contained perhaps four times more B.t.u.'s per unit of cost than found in the gas. It further demonstrated the fact that the thermal efficiency of the gas furnace was several times greater than the coal furnace.

A large oil-producing and refining company used large quantities of manufactured gas for heating solder baths at their refinery, where there was almost an unlimited quantity of crude oil, fuel oil, gasolene and kerosene.

The industrial heating department of a large and well known gas company found from actual operations that under the best conditions of oil utilization they could substitute 1,000 cubic feet of a 600 B.t.u. manufactured gas for 5½ gallons of 142,000 B.t.u. oil. Where oil was used at a low efficiency this company found that 1,000 cubic feet of 600 B.t.u. manufactured gas could be substituted for 14 gallons of oil of 142,000 B.t.u.'s per gallon.

In other situations the same company was able to substitute 126 B.t.u.'s of manufactured coal gas for 210 B.t.u.'s of producer gas. Again, 253 B.t.u.'s of manufactured coal gas gave the same results as 504 B.t.u.'s of producer [illegible]

Correct Basis of Comparison

The above occurrences confirm the statement that fuels cannot be compared in relative heating value by their B.t.u. content in the fuel state. The only correct basis of comparison is the heating value of the combustible mixture. This fact is well established theoretically. A few calculations will show that a [illegible] of 600 B.t.u.'s per cubic feet will give a theoretical flame tem-

perature of 3550° F. and a heat content of 100 B.t.u.'s per cubic feet in the products of combustion, while a blue water gas of 300 B.t.u.'s per cubic feet will develop a flame temperature of approximately 4000° F. and a heat content of 107.5 B.t.u.'s per cubic feet in the products of combustion.

Yet in the face of these facts, both theoretical and practical, we find many practical steel treaters in favor of coal and oil because of their erroneous belief that the B.t.u. value of the fuel as fired to be the real measure of its utility.

The principal combustibles in the fuels under consideration are carbon, hydrogen, and their many combinations known as hydrocarbons, also carbon monoxide. In addition to these are the incombustible such as nitrogen, oxygen, sulphur, carbon dioxide and ash. The combustible elements when mixed with air give a flue gas composed of carbon dioxide, water vapor, sulphur dioxide, nitrogen and carbon monoxide. Furthermore, by changing the proportion of air in the flue gases gives rise to three general conditions within the furnace: a reducing, neutral, or oxidizing atmosphere. These conditions are essential and are of great importance in different heat-treating processes. They also have a very vital relation to fuel economy and furnace efficiency.

A reducing atmosphere (one in which an insufficient amount of oxygen has been admitted with the fuel to give complete combustion) is a condition often desirable in heating tool steel and other steel parts, in order that no oxidization or scaling action shall take place. The flue gases should show a small percentage of unburned gases.

A neutral atmosphere is one which is hard to obtain with any of the fuels except gas. It represents a condition in which just enough oxygen has been admitted to completely burn the carbon hydrogen and other combustibles present. In this case a flue gas analysis will show no free oxygen or unburned gases.

The condition most frequently found in furnaces is the oxidizing atmosphere, where an excess of oxygen is necessary to accomplish certain results, or where too much has been admitted through poorly designed apparatus. This condition is very noticeable in coal-fired furnaces, where it is necessary to burn the coal with a large amount of excess air. Such a condition within the furnace is harmful in many ways. It causes over ventilation and thus carries away much of the sensible heat of the unburned gases. It produces a chilling of the flame, lowers the temperature of the furnace, and thus reduces its thermal efficiency. Steel exposed to this furnace condition oxidizes very rapidly.

For industrial heating operations, gaseous fuel should always be mixed with air before the gas has reached the zone of combustion, and in the proper proportion to give the desired furnace atmosphere. For all metal-treating work, some mechanical means should be used to produce air at sufficient pressure and thoroughly mix it with the gas. This is of great importance in burning gas. Many devices are used, but all may be grouped under three general types.

OTHER POINTS OF INTEREST

Fuel oil often contains a small percentage of water which lowers its heating value. For each one per cent. of water, the heating value is reduced 13.14 B.T.U's.

Fuel oil is particularly adaptable to heavy forging work such as drop forgings, heating of heavy bars, and so on.

Gaseous fuel is economical because it can be applied in a way most adaptable to the requirements of the piece to be heat treated.

(1) The Air Injector—air under a pressure of a few ounces to one or two pounds per square inch is passed through an injector. Gas is admitted to a chamber surrounding the injector and the high velocity of the air in passing through the injector opening entrains the gas and the mixture is then led to the burner. This method requires both air and gas piping to the injector. It further requires valves on both the air and gas pipes and these are changed by the furnace attendant to give the desired mixture.

(2) Gas under relatively high pressure—under a pressure of from 8 to 10 pounds per square inch gas passes through a small orifice and entrains air under atmospheric pressure. The resulting mixture is led to the burner located nearby.

(3) Gas and air-mixing machines—a machine designed for this special purpose is located at a convenient point. Air and gas are brought together inside the machine in any predetermined proportion within the limits required for combustion. By means of a pump or fan the mixture is distributed from this point by means of a one-pipe system to the point of consumption.

It is to be regretted that in the majority of gas-fired furnaces the air injector is used for mixing. This is largely due to a lack of initiative in the past on the part of gas engineers, and also on account of the ease with which an injector may be constructed. We have no particular antagonism to the air injector as a mechanical means of mixing the air and gas, but the greatest evil lies in the very uncertain proportions of air and gas thus obtained by means of manual adjustment of the valves usually administered by unskilled furnace attendants. It is no exaggeration to say that the ordinary furnace fitted with an air injector and a two-pipe system and operated by the average furnace attendant will use as much as 50 per cent. excess air.

With the high pressure gas inspirators and air-gas mixing machines it is very easy to make adjustments that will mechanically control the air-gas ratio to give the desired furnace condition. After this adjustment has been made it is only necessary for the furnace attendant to regulate one valve in order to give more or less heat as the occasion may require.

Transferring of Heat

The application of heat in furnaces to the metal to be treated is another subject of great importance and one too often overlooked. Heat may be transferred from one body to another, or applied to a body from the point of combustion in three different ways—by conduction, convection and radiation.

Heat transfer by conduction takes place when it is transmitted from one part of a body to another without the occurrence of motion in any definite part or parts of the body, intermediate points being heated meanwhile. Thus a steam radiator becomes hot on the outside due to conduction of the heat of the enclosed steam within the radiator which passes through the iron to the exterior. Placing one's bare foot on a tile floor in a room well heated will give the impression that the tile is very cold. While if the foot is placed on a rug it will feel much warmer. As a matter of fact the tile and rug are perhaps of the same temperature, but the tile being a much better conductor than the rug, absorbs the bodily heat from the foot much quicker than the rug and is therefore known as a good conductor.

Heat transfer by convection takes place when it is conveyed from one place to another by the movement of air currents, or the circulation of liquids. When heat is applied to the bottom of a pan of water, almost instantly minute vapor bubbles form in the bottom of the vessel. These presently ascend and impart heat to other parts of the water, while cooler water takes its place at the bottom.

Heat transfer by radiation takes place when heat is transferred from a hot body to a colder one by a wave-like motion of the ether that occupies all space. The ordinary cast iron steam or hot water radiator starts a wave-like motion of the surrounding ether in all directions, and as these travel outward from the radiator similar to the waves of water when a stone is thrown into a still pond, the heat is imparted to the room, and this transfer of heat is called radiation.

For all practical purposes of furnace design the heat of combustion is transferred to the material to be heated by means of convection and radiation. Heat transfer by conduction is to be avoided as much as possible, for by this means the efficiency of the furnace is very much lowered if heat is allowed to be

conducted through the furnace walls and lost. For this reason it is important that all furnaces should be thoroughly insulated with the best kind of non-conducting material in order to reduce such losses to a minimum.

In the usual type of furnace, the heat is transferred by convection to the walls and arched roof, and from these a radiant heat transferred to the material to be heated. Then in order to get the maximum amount of radiant heat from the gas burned, there must be as near complete combustion as possible with a minimum amount of flue products.

The proper furnace conditions are hard to obtain with any degree of certainty or uniformity when coal, coke or oil are used to produce the heat. On the other hand, gas, on account of its flexibility of application, can be made to accomplish far better results.

Coal and coke are seldom considered to-day in connection with the larger and more important heat-treating operations because of the difficulty in maintaining proper furnace conditions.

Oil can no longer be considered a cheap fuel for furnace heating on account of the economic demand for it for other purposes.

Natural gas supply is continually growing less, as evidenced by the increase in shortage during the winter and the construction of manufacturing gas plants to augment the suppiy.

Producer gas plants and others that use coal at the sacrifice of the valuable by-products will sooner or later go into the discard.

It is possible we are approaching the dawn of a new day in industrial economy, a day when the gas manufacturing company will become a central fuel station from which can be supplied the entire fuel demand for industrial heating, but on account of the ridiculously unreasonable standards of candle power and heating value placed upon the gas companies by the State Utility Commissions in the past, it has not been possible to produce a gaseous fuel of the greatest economic advantage.

Question of Proper Fuel

The question of fuel costs is a very vital one to every manufacturer. Unfortunately a decision has often been reached on a purely heat unit basis, without considering the efficiency of application and many items of expense incurred in handling such fuels before they reach the zone of combustion.

In the foregoing remarks the aim has been to state a few of the characteristics of each fuel together with some of their advantages and disadvantages. It must be remembered that the true fuel cost is not the cost of coal per ton, oil per gallon or gas per thousand cubic feet delivered at the factory, but rather the cost of these fuels delivered to the hearth or heart of the furnace.

There are many items of expense such as the handling of coal, removal of ashes, investment in storage equipment, labor, time lost in getting started with coal or oil, the noise and smoke nuisance so peculiar to the oil fire, and the deteriorating effect of coal and oil on the furnace causing frequent repairs. The proper fuel is the one which, regardless of cost per ton, gallon or cubic foot, gives the corerct heat application, perfect combustion, and proper temperature control.

Therefore in the final analysis the true furnace efficiency is measured by the quality of the work it produces and the cost per unit of product, and not upon the relative cost per unit of fuel consumed.

CAPACITY OF LOCOMOTIVES

(Continued from Page 40)

with deep fireboxes between frames have become obsolete on many large roads, but on the small roads and on branch-line and local train service in much of the New England territory these engines, modernized as far as consistent, should be carefully considered where the traffic conditions warrant.

Because of limiting weight conditions, Mogul or 2-6-0 type locomotives have been assigned to passenger-train service on some outlying divisions. The application of superheater and piston-valve steam chests with outside steam-pipe connections as the principal features of improvement has increased the economy of these engines, added one passenger car to their tonnage capacity, and reduced train delays. Outside valve gears were not applied, shop limitations preventing, but their addition is desirable.

Atlantic-type locomotives having outside valve gears have had their capacity and economy increased by the application of the superheater. This work permitted the use of the engine in long-distance through service which was not previously successful.

Consolidation locomotives reconstructed with superheaters, new piston-valve cylinders, outside valve gears, new front-frame sections, and frame cross-ties have also had their capacity increased, and have been successfully used in regular freight service on a mountain division needing much power. The cost of the above-mentioned improvements, including heavy general repairs and entirely new fire-boxes, would not exceed one-half the cost of new locomotives of the same capacity.

When rebuilding locomotives there is a favorable opportunity for replacing old tenders as well, transferring the latter to older locomotives for spare use or as substitutes for damaged equipment. When the condition of old steel tender frames requires that they be replaced, the one-piece steel casting and a larger-capacity tank should be used, as both will reduce future expense in repairs. The success of autogenous welding eliminates any objections to the use of large steel castings for fear of breakages.

Tanks should be reconstructed in coal space to permit gravity delivery of the greatest amount of fuel that is possible at the coal gates within reach of the fireman's shovel. Application of power-operated coal pushers should be made to tanks where alterations for the gravity delivery of coal cannot be satisfactorily made and where the service conditions will show a saving in expense by its use over hand methods of shovelling forward coal while on the road or at short lay-over stations. Moving forward the rear coal board or plate on tanks and building higher side plates or "dickies" is one method which has been successful in making the maximum amount of coal accessible at the gates. Furthermore, care must be taken not to overload the journals of the forward truck axles.

By means of a method of chemical analysis, in which the electric arc is utilised, Mr. W. R. Mott, an American research chemist, claims to identify readily about sixty-five elements, picking them out from their ores, compounds with oxygens, or alloys. According to the Chemical Trades Journal, the apparatus required is simpler than that for spectroscopic analysis, and includes a carbon arc lamp so enclosed as to project upon a screen an image magnified 20 diameters. A half-gram sample of the material to be tested is placed in a cup-like cavity, two-fifths of an inch wide and deep, hollowed out of the positive lower carbon of the pair. The elements are recognized by various phenomena, including the nature and colors of the material deposited on the carbon pole from distillation, the smoke, sparks and flame-tip color shown, and the odor of the fumes emitted, with many other peculiar characteristics. The smoke emitted from the hot upper carbon when the arc is broken appears only when molybdenum is present, being a delicate test for that element. The present of calcium is shown by its peculiar red color, and characteristic odors reveal iodine, arsenic, and tungsten. Many elements difficult to determine in other ways are said to be clearly identified by this new system.

CATALOGUE ON CRANES

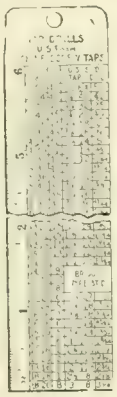
The Milwaukee Electric Crane and Manufacturing Company of Milwaukee, Wisconsin, has just issued a new 48-page catalogue illustrative and descriptive of their complete line of cranes. Much valuable information, the result of twenty-five years of active experience in the designing and building of hoisting machinery for shops, foundries, steel plants, and other establishments, is incorporated in this book.

Those interested in electric cranes or hoists, and especially in the prevention of accidents, will find this book chuck full of interesting data. A section of the catalogue is devoted to the horizontal drilling and boring machine made by this company and which is especially suited for operating, at one setting, on pieces too long or bulky for the usual type of machine.

Have You Tried This Contest Yet? If not--- Do so Now

Do you want to win one of these scales?

It's very easy, and at the same time you add to your store of knowledge. The details are given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

There were 8 correct answers to our Dec. 16th contest. The ninth answer was so well recorded that we cannot help but send a scale to him as well as the winner. Here is how it happened: GORDON B. RILEY, who is the chap who had all correct but one, was really the fellow who would have been correct had the advertisement appeared for which query No. 11 was intended. We expected to run an advertisement for the W. S. Rockwell Co. In that advertisement was a cut of a blast gate. The reading matter suited our query No. 11 exactly. The advertisement was left out, however, too late for our changing the query. Mr. Riley stated in his letter that the advertisement that seemed to him as best suited to the query had appeared on Page 53 of our Dec. 9th issue. As this was perfectly correct, we award him a scale as well as the winner.

Here is the actual winner, R. P. BROWN, of the Garlock Walker Machinery, Ltd., Toronto, Canada. He stated Kearney & Trecker was the answer to query 11. This tallied correctly with the advertisement that appeared. Five others were correct in their lists, but were several days behind Mr. Brown in sending their replies. The others who were correct are as follows:

W. O. Bird, Edmonton, Alta.; Frederick Cubaynes, Chicoutimi West, Quebec; E. Bowers, Welland, Ont.; G. A. Todd, Penetanguishene, Ont.; J. J. Doyle, Brantford, Ont.; Geo Land, Peterboro, Ont., and K. M. Horton, Yarmouth, N.S

CONTEST FOR JAN. 13TH ISSUE

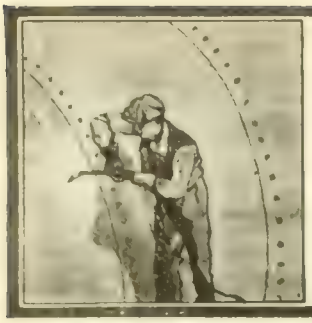
Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something said to be a service to Canadian industry.
2—How to obtain full details of every heat treating operation.
3—How to keep down the cost of upkeep.
4—What to do if you desire strength and dependability.
5—How to get high speed combined with safety and power.
6—How to obtain air and steam tight jobs.
7—Something to watch for carefully.
8—How to secure something original.
9—How to obtain versatility.
10—How to create confidence.
11—A product that can be adopted for motor or chain drive if desired.
12—How to find what you want.

These are Correct Answers for List from Dec. 16 Issue:

1—A. R. Williams Co.
2—Wisconsin Electric Co., Ltd.
3—J. T. Ryerson Co.
4—J. Morrow Screw & Nut Co.
5—Union Carbide Co.
6—Canadian Blower & Forge Co.
7—General Combustion Co.
8—The Frost Mfg. Co.
9—The Shore Instrument Co.
10—The Independent Pneumatic Tool Co.
11—Kearney & Trecker Co.
12—Butterfield & Co.

Closing Date for This Contest is February 3rd!



WELDING AND CUTTING

Foreign Comment on Effects of Alloys in Steels

A Discussion of Welding in General—English and French Journals Comment on a Previous Statement Made in One of Our Welding Lessons—They Prove Interesting

By W. B. PERDUE, Director Welding Department, Healds Engineering School, San Francisco, Cal.

AN article which was originally printed in the June 3rd issue of Canadian Machinery seems to have attracted considerable comment, both favorable and unfavorable.

Despite the fact that the article contained the statement that "American products are made which excel by far any imported article which can be procured," it was translated into other languages and printed in its entirety by several foreign metal trades journals.

In this article, as in other writings on the subject of welding, I gave out the results of exhaustive tests which can be duplicated wherever tensile machines and other apparatus are available. The tests made by myself have been repeated in many other sections of the country, and in each test the results have been identical. As the engineer of a large steel producing concern engaged in the manufacture of special welding rods put it:

"We enclose a table of tensile tests applied to parts welded in various parts of the country by operatives both skilled and unskilled. You will note that these are in full accord with your articles on the subject. We label all our products with our own trade names, omitting any statement which would indicate the fact that they are steel or iron. Some welders use our steel wires thinking them to be wrought iron, and would even quit buying if they were disillusioned. The adverse comment abroad on your article merely shows the fear of American competition—in fact we have good cause to believe that these criticisms of your article have brought inquiries which may lead to considerable export business."

It is so easy to make an actual test to determine the merit of a welding material that it seems unusual for the [illegible] of a reputable trade journal to express an opinion unsupported by facts. The following extract from a letter written by one of the best known engineers [illegible] to bear out this statement with regard to the London "Acetylene and Welding Journal."

"The printing in our local 'Acetylene and Welding Journal' of a criticism of your article on the 'Effects of Alloys in Steels' is most unfortunate. The tone of the criticism is such as to foster and perpetuate the old idea that wrought iron can be used as an all purpose filling material."

"We entirely agree with you in your statement that 'the metal added must be similar in analysis to the original metal.' It is impossible to procure iron with sufficient tensile strength for use in life and death welds."

From a Well Known Paris Authority

"Where welds are to be made in alloy steels we consider it of essential importance that the nature of the alloy be determined, and a steel filler rod selected that will supply the ingredients most liable to be destroyed or burned out in the execution of the weld."

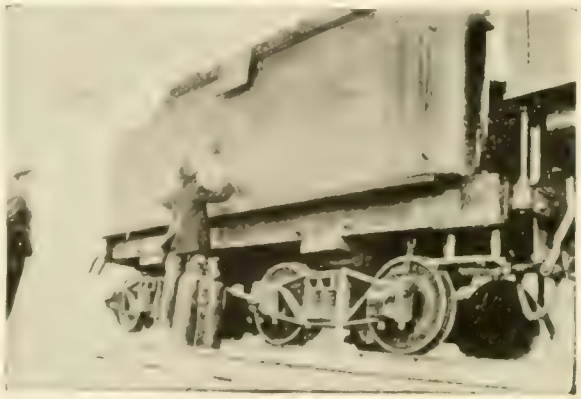
From a Large English Firm

"Recent tests of American welding rods, made since the appearance of the criticism of your article, were very much of a surprise to us. Tests of American products bought in open market several years ago proved them far inferior to those now available. We do not regard them quite the equal of our —— fillers, but believe those tested to be far superior to the average product of our competitors." Naturally, the salesman can not afford to admit that anything is superior to the goods he is selling.

Evidently the printing of the criticisms of these articles has served to attract attention to the articles themselves and incidentally to the quality of American goods as now produced and sold.

I do not for a moment question the sincerity of those who expressed criticisms of the article in question. I do question, however, the policy of expressing an opinion without determining the facts. We know by reason of oft repeated experiments that the tensile weakness of the very best wrought iron is such that it can not serve to bond parts of alloy steels which may have a tensile strength more than double that of the iron filler. To give the impression that it is unnecessary to make a special study of alloy steels and in each case select the proper filler is to promote a dangerous doctrine.

The phenomenal growth of the automotive industry in the United States, which eclipses that of all other countries combined, and of many other industries in which similar uses of the oxy-acetylene process is slowly but surely superseding more costly means of metal joining has afforded a wonderful incen-



A PECULIAR JOB FOR THE WELDER

tive to scientific investigation in this country.

Vague theories, which may still be common in countries where welding is considered only as a means for emergency repairs, have been dissipated. When a demand is found to exist those who are in position to increase the markets for their products by producing a satisfactory article are quick to realize its possibilities and to supply the need. Think, for instance, how valuable would be a ferrous metal which could be used to produce a true weld in malleable iron parts!

In other countries the interest in welding is just as keen as in ours. The opportunities for invention, however, are lessened, due to the fact that there are not enough competing concerns able to finance and carry on the expensive experiments necessary to determine the value of some new idea. Fortunate indeed is the student of welding who lives in North America.

Steel—the Master Metal

The amount of iron produced as wrought iron to-day is less than 10 per cent. of the amount produced 20 years ago. The demand for this particular product is rapidly waning. On the other hand, the demand for steel—and especially for high-grade alloy steels—is increasing with greater rapidity than that of any other known industrial metal.

Some day these various alloys of steel will be standardized and classified. The International Acetylene Association is now calling for facts stating the chemical analysis of the steel plate used in the construction of pressure containers and the analysis of the filler found to give the best results therewith. Such information will some day be available. The writer holds that the welding and steel industries are both too young for the tabulation of complete information on this subject, although much may be accomplished in the very near future. The principles given in my article in the May issue and repeated below are intended to govern the choice of fillers until such information is complete.

"First, that the steel rod added must be similar in its analysis to that of the original metal."

"Second, that none of the essential characteristics of the original metal shall be destroyed in the execution of the weld." When there is a tendency to lessen the proportions of any of the component alloys, a welding rod which will make good this loss must be used.

"Third, that the grain of the weld shall be equally fine as the original section welded." Heat treatment or other means necessary to produce this result may be used where a 100 per cent. weld is sought.

My own experience in supervising an average of more than 1,000 welds per month has taught me that etching, microscopic and tensile tests are essentials of the business, and that any appreciable change in the analysis of the plate used in pressure containers or other work where the strength of the weld must be from 80 to 95 per cent. that of the rolled plate demands a specially selected filler—a filler with a tensile strength far in excess of the best wrought iron that can be manufactured.

Any weld made by a good workman that is "beaded through," that is, in which the ripple shows on the reverse side, and that is very slightly reinforced will stand a greater tensile pull than the plate itself—provided the right kind of filler has been used, together with a torch which stirs the gases into thorough mixture.

In this series of articles I have outlined the method of preparation of almost every type of weld in steel; have emphasized the necessity for securing proper penetration; and have shown the beginners how to practice torch movements until they attain proficiency.

POINTS BROUGHT OUT

That sometimes a product is labeled incorrectly. In one case welders used steel wires, thinking them wrought iron.

Recent test of American welding rods proves them to be of the best quality.

The amount of iron produced as wrought iron is less than 10 per cent. of the amount produced 20 years ago.

Every welder should have a few samples of his various alloy steels tested, then label them, so that he can determine the characteristics of the sparks. In a short time he will be able to distinguish the common alloys by sight without grinding.

Others have pounded the truth home through these columns in regard to these matters, but we've had many failures. Why?

Because many of our welders do not know the analysis of the metals upon which they are working nor the filler that they are using. More than 75 per cent. of the welding supply houses can not tell you the analysis of the rod they "personally guarantee." Try it. Next time you meet your supply man ask him the analysis of the various rods he sells.

Now I do not mean that every welder must install a chemical laboratory in his shop, but he should at least obtain a few samples of the various alloy steels and have them properly labeled to use as wheel tests to determine the characteristics of the spark. In a few weeks he will be able to distinguish most of the common alloys by sight without grinding.

It took years to develop the cast iron welding rod with an increased amount of silicon and the bronze welding rod with the correct proportion of phosphorus and aluminum. Even now many shops are trying to get by with common "Tobin" or "manganese," instead of a specially prepared and drawn welding bronze.

My experience has been that best results have been obtained with steel plate and rod in which the percentage of phosphorus and sulphur are kept at a minimum. The percentage of other alloys, including carbon, should be as nearly equal as possible. I can furnish the names of dozens of operators who can make welds with "similar metal" that will stand greater strain than the balance of the plate.

Reinforced Welds

Lastly, a word to the critic. The welding industry needs facts. If you have obtained extraordinary results with a filler in which the amount of carbon was so many per cent. less or more than the plate welded, and a certain increase or decrease in the amount of manganese or other alloys was found beneficial tell us about it either through these columns or by personal letter.

Possibly, too, we owe our brothers across the water some sort of an apology. In making the statement "American products are made which by far excel any imported article which can be procured," we referred to the markets of North and South America. We did not hope to see our original article quoted all over Europe. Surely with the same formula, materials and facilities as are used in the production of the highest grade American products they could be duplicated in any other part of the world.

THE WEIGHT OF A BLOW

Should there be a relation between the size of a tool and the weight of the blow struck? Certainly! For would not the use of a 7 or 10-lb. hammer, on a ¼" punch or chisel soon ruin the tool? It may be shown as a ready example of this that while you can drive a 16-gauge 2 in. wire nail into an ordinary brick until its head is flush, if you use a 4 oz. to 6 oz. hammer, yet if you use a 2 lb. hammer the nail will not enter, but simply collapse; in effect this is the same with all percussion tools. If you have a big-bodied chisel or punch you can use a sledge hammer on it, but if you have a small-bodied tool only a small hammer can be effectively used, and for the usual ⅛ in. to ⅝ in. hexagon steel punches and chisels more work can be done with a ¾ lb. to 1 lb. hammer than with one of larger size, owing to more of the force being utilized.

Five men were seriously burned about the face and arms, when one of the employees of the Pratt and Letchworth Co., Brantford, stepped back suddenly, striking a man carrying a ladle of molten metal.

DEVELOPMENTS IN SHOP EQUIPMENT

NO. 2 MAXIMILLER

The Kempsmith Manufacturing Co., Milwaukee, have placed on the market their No. 2 plain maximiller. This machine is of similar design to their No. 4 size and has the same balanced weight, rigidity, convenience of operation and efficiency in production. Its size adapts it to the medium heavy classes of automobile and aeroplane work, and it will also be found valuable in tractor, steam turbine and agricultural machinery plants. The very highest class of materials obtainable are used. All gearing stock is purchased to exact chemical analysis and is scientifically treated for the particular use to which it is put. Much of the shafting, especially that in the speed train, is also heat treated alley steel.

The column, knee, saddle and table, which constitute the main frame numbers, are of semi-steel, and have been carefully designed in regard to relative weight and strength. An exceptionally large area of base provides stability for the entire machine. No weight whatever has been added merely to have a heavy machine. Every pound of metal used is well placed, and serves a useful purpose.

The knee is of the solid top design, there being no openings whatever in the top plate of the knee. This construction serves to better resist clamping strains and the torsional effect of the table overhang. The side walls of the knee are practically solid, there being but two small openings, which are closed by plates. Cross-feed screw is located in a shallow depression in the top of the knee midway between the saddle V's. The greatest possible strength and accuracy is the result as the pull or thrust of the cross-feed screw is applied to the [illegible] of the saddle.

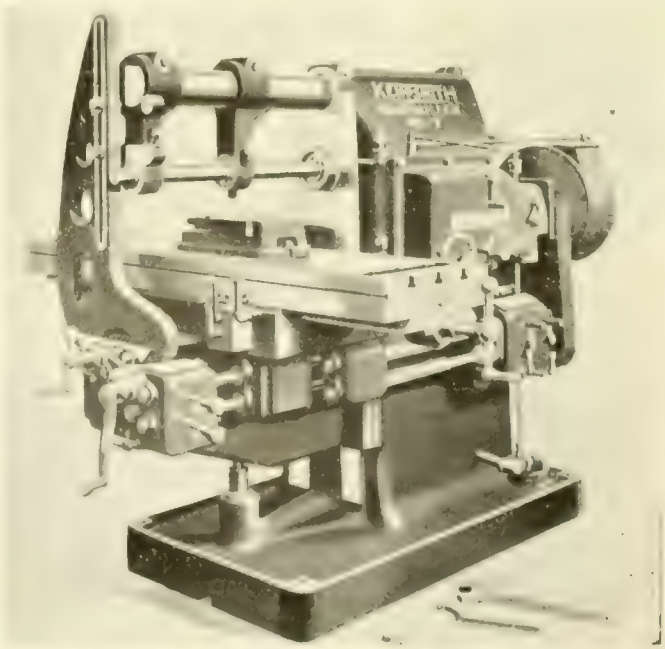
Column is well ribbed internally and has very few and small openings. The reservoir for the speed drive oil forms a solid rib or cross member midway of the column height, which has a great stiffening effect on the column. Saddle is long, heavy and rigid. Drive to table is located near end of saddle, which leaves the center and where the most strain comes. Table is 12 inches wide with 56 inches working surface in length. Table gib is of adjustable taper type with locked adjustment.

The [illegible] is a [illegible] bar 1¼ [illegible] and is a patented "wedge lock" type which keeps the arbor in alignment with the spindle at all times. The spindle hose is of patented type which provides for driving face milling cutters in either direction and also permits cutters to be quickly and easily removed. Right hand design has been used which means that normal direction of spindle rotation is correct for standard drills and boring tools. A spindle reverse has been incorporated in the machine for the reason that in order to get cutting strains in proper direction on gibs and tables a face mill must be run in the opposite direction to a spiral or slab mill.

The clutch is of friction plate type operated by a hand lever located at the front of the machine where it can be easily reached by the operator. Friction surfaces of clutch are large in diameter and are forced together by a combination toggle and plain lever movement which gives the required pressure on the plates with very little effort on the operating handle. Clutch is adjustable for wear without dismantling the unit. A brake operating on the reverse throw of the clutch lever overcomes the momentum of the spindle gear train and stops the spindle quickly.

The drive pulley is 15 inches diameter, takes 3½ inch double belt and runs at 400 R.P.M. It is mounted on ball bearings and with the clutch is enclosed in a protecting housing. The control of the longitudinal movement is by two levers, one for the feed and one for the power quick traverse. The operator merely pushes the one required in the direction he wishes the table to move. The knee and saddle movements are both controlled by a second set of levers, the unit which shall move being determined by push pins located in close proximity to the respective hand feed handles; while feed or quick traverse is determined by which lever is pushed. Operator can control the movement of the table in any direction either by power feed or quick traverse without moving from his position at the front of the knee.

The cooling system is a part of the machine. Pump is of the centrifugal type driven through a clutch which can be disengaged if the nature of the work does not require the use of a cooling fluid. The capacity of the pump is about 15 gallons per minute delivered to the cutter. Lubrication of all working parts has been given careful consideration in the design of the Maximiller. The gears and bearings in the entire speed and feed mechanism run constantly in oil and are lubricated by splash. The only exceptions to this are the sight feed oilers



GENERAL VIEW OF THE NO. 2 MAXIMILLER

used to supply fresh clean oil to the spindle bearings and drive pulley. The lubrication of all mechanism supported by the knee is centralized at two points which make it certain that none will be overlooked.

The spindle is very large and runs in phosphor bronze bearings which are easily adjustable to compensate for wear. All other shafts in the speed transmission run on ball bearings. The entire spindle drive is located in an oil tight case and runs in oil. Feed change mechanism provides 18 changes of feed ranging from 5-8 inch to 25 inches per minute in geometrical progression. The gears are all heat treated steel and run in an oil bath.

Quick Traverse

The power quick traverse is available for all table movements without disturbing the set up for whatever rate of feed may be in use. The available feed rates remain constant, but power quick traverse rate has been reduced for the cross and vertical feeds to compensate for the short travel distance of the former and the greater load in the latter case. The longitudinal power quick traverse, is at the rate of 100 inches per minute while the cross and vertical travel is at the rate of 36 inches per minute. Oiling directions for this machine are simple and complete, a small plate on the speed box being all that is necessary to explain them to new or unskilled operators.

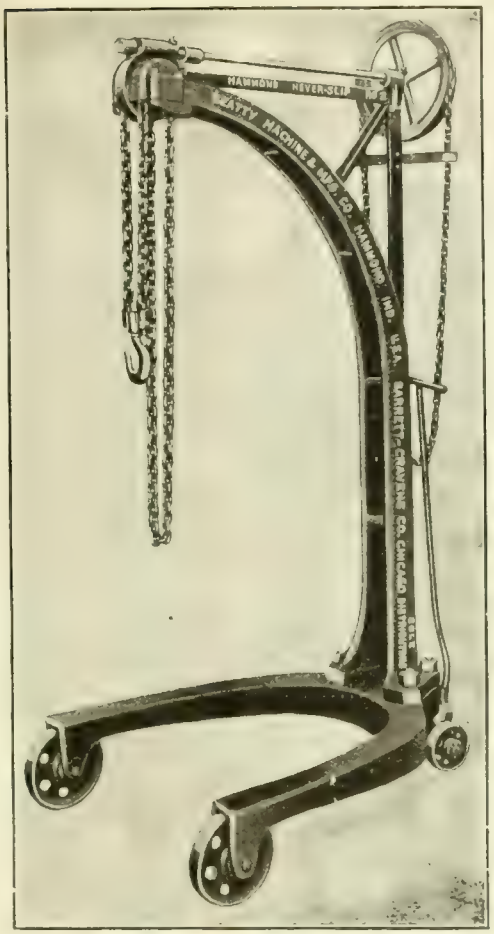
The drive is of the single pulley type through a train of gears giving 18 changes of spindle speed ranging from 16 to 400 R. P. M. All speed changes are secured by sliding gears, there being no tumbler gears, clutches or locking pins. There are never more than three pair of gears in mesh. All heavy cuts are driven through the large spindle gears, the gear arrangement being such that all cutters above 3 inches diameter are normally driven through this gear. When desired and at an extra cost we can furnish the above machine arranged for motor drive through belt in which case the motor recommended is 7½ H.P., running at 1,200 R. P. M.

PORTABLE CRANE

The Barrett-Cravens Co., Chicago, Ill., have placed on the market a portable crane which is claimed to have various outstanding features.

The crane is of all steel construction, and the load is locked at all points of travel. The lifting mechanism is of the worm and gear type, thus allowing the load to be raised to any desired height, even to a fraction of an inch. This is, of course, a desirable feature when assembling or dismantling heavy machinery.

The hoisting worm gear is made of bronze, and the screw is cut from solid steel shafting of goodly proportions.



GENERAL VIEW OF THE PORTABLE CRANE.

Both are enclosed in an oil tight cast housing to permit proper lubrication. The axle is chrome nickel steel, heat treated, and Hyatt roller bearings are used in all the wheels. The treads of the wheels are chilled to ensure long wear. The Ontario representative for this concern is the Anglo-Canadian Metals, Ltd., 52 Spadina Ave., Toronto, while B. and S. H. Thompson & Co., Ltd, 210 McGill St., Montreal, handle the other provinces in Canada.

DRILL ATTACHMENT FOR MILLERS

The Purves Manufacturing Company of Syracuse, N. Y., are placing on the market a special attachment for the drilling of holes in work carried on the table of the milling machine. The fixture is so designed that the work may be located on the table without the use of a jig and the holes drilled to any desired angle by swinging the attachment to the required position. A small hand lever is provided for feeding the drill, this method giving a more sensitive control and aiding materially in preventing drill breakage. The feed lever may be placed in different positions to accommodate various shapes of work. For depth drilling adjustable stops are provided.

22-INCH UPRIGHT DRILL

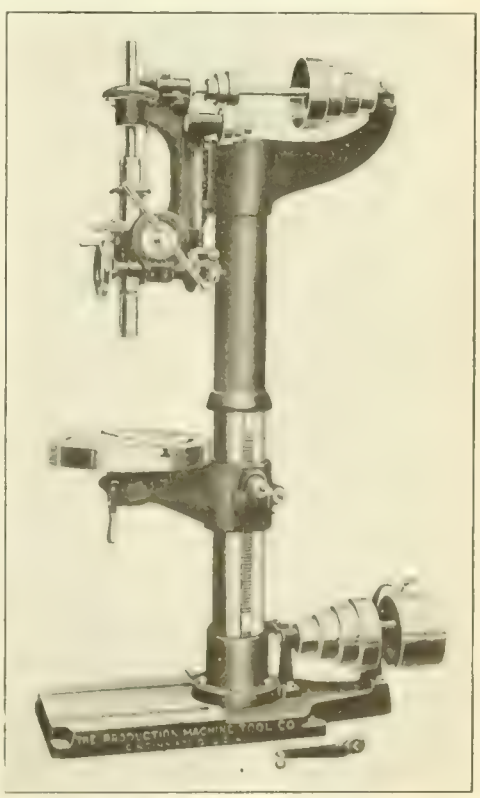
The Production Machine Tool Co., Cincinnati, Ohio, have placed on the market a new 22-inch upright drill. This machine has stationary head, bronze bushed throughout. It is built to do the regular type of drilling, boring, tapping, and facing work up to its range of 1¼-inch diameter drill.

The machine is regularly built with power feed, but this can be omitted if desired, Back gears, and tapping attachment can be added together with the type of drive best suited to conditions under which machine has to be used.

The frame is of ample proportion. The column is of tubular section, and if sufficient stiffness to withstand all strains. The table arm is a single casting and of box construction. The table is well ribbed, and has four tee slots of the same size as those in the base. Four radius slots are also provided. All other parts are proportioned to withstand heavy usage.

The drive is by means of tight and loose pulley through driving cones of large diameter and wide face. The driving level gears have a peripheral speed of less than 800 feet per minute. The spindle sleeve is bronze brushed, and the spindle has a suitable ball bearing for thrust. Four spindle speeds are obtainable on the plain machine, with four additional speeds through back gears.

A by-law was passed by the ratepayers, Dunville, Ont., authorizing an expenditure of $40,000 on a four-room addition to the public school.



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PRINCIPAL CONTENTS

The Cancellation Germ

ONE of the poorest things that has been allowed to grow up and become incorporated in our business system is the cancellation of contracts or orders.

There are undoubtedly cases where the only way out is to cancel, but the tendency of our commerce and trade should be set against this practice rather than in favor of its continuance.

Just this week Canadian Machinery talked with British agents in Canada, who were certain they could not take the business of certain Canadian firms to their houses again because it would not be considered until such time as they had discharged the obligations now on their books, but which they had seen fit to cancel.

In most cases the first intimation given that there was any intention of cancelling was when the expressman brought the goods to the door of the company's plant. Then the only word was to the driver of the wagon, and it ran like this, "Take these back, we don't want them."

There were cases in which these orders had been placed some months ago. The agent here had taken the business and sent it to his home office, where it had gone through the usual work in the factory and in some instances special work was required to meet the requirements of the firm

There are too many contracts cancelled in this country. A contract is a business obligation and if the firm to whom it is given lives up to its terms, it is the legal and

The reason why these business obligations are not dis- the majority of cases, because it will not

It pays better to disregard business obligations, therefore disregard them and let the other firm worry about what is to be done about it.

ing with such matters as disregarded business obligations. It is a vicious practice and once started, strikes farther than any one would dare do in any other way.

Going through a season such as we are now, with contracts being cancelled simply because it does not pay consignees to honor their orders, creates a feeling of business instability that is hard to overcome and difficult to counteract.

It is generally understood that where a firm fails to make shipment on time, or where the goods are not up to samples, or faulty in any way, there are grounds for refusal and rejection. It is right and proper that such should be the case. This is a perfectly legitimate practice, and a defence for good business methods.

But this is far removed from the cancellation craze that has taken business by the throat in this country.

The way to weed out the cancellation germ is to weed it out.

Let us have in Canada a business community that will recognize contracts, and regard them as business obligations which they are morally bound to discharge.

Time To Face Facts

THE International Harvester Co., at their Hamilton plant, publish a paper called "The Bulletin" each month. The current issue contains an appeal to the employees from the management. It goes on to point out that conditions are changing and that it is a harder matter for the firm to keep going than it was a few months ago.

Many a plant will find its own case stated in the appeal that is made for the elimination of the scrap heap.

Here is the way in which the case is stated, after reviewing the money markets, and showing how much more it costs to borrow necessary money now than formerly:

"So you see where we stand. There is no way to dodge the issue. We have got to meet it and go through. Every man and woman on the payroll will have to get down to business. Every one of us will have to save money for the company. We will have to get practical and ask ourselves practical questions:

"How much does a scrap pile cost?

"What does one bolt, lost or scrapped, cost, when multiplied by a thousand or ten thousand?

"What does a pound of brass cost, or a handful of nails, or three sheets of paper, or a pocketful of pencils—multiplied by the number of employees and purchased with borrowed money?

"How much does fifteen minutes of wasted time cost the company?

"What is the penalty of an hour a day lost from creative work?

"How much does it cost for every call a salesman does not make during the day, and for every unproductive call

"The time has come to ask ourselves the bluntest and most practical questions and get our schedules down to bedrock. In other words, we had just as well face it—to be an asset to the company we will have to be efficient.

"And it is an exceedingly poor time for any man to be anything but an asset to his company."

It is stated in a recent report for 1919 that the total amount of tar distilled in the United Kingdom equalled 1,509,043 tons, of which 1,402,987 tons were obtained from gas and coke oven works. For pitch, out of a total of 698,290 tons, the gas and coke oven works contributed 636,435 tons.

Canada's 1919 Iron, Steel and Tool Trade

DURING the year 1919 Canada imported from other countries a total of $181,332,310 in iron and steel. The year before it amounted to $173,340,779. The year 1920 may show a decrease. The great bulk of this came from United States.

Canada imported more iron and steel in 1913 than in 1917.

Here are some of the amounts coming in during the year 1919:

	Tons	Value
Pig iron and kentledge	35,800	$ 1,022,871
Ferro-alloys and chrome	16,423	943,584
Ingots, blooms, billets	12,135	494,101
Scrap iron and steel	39,790	482,963
Plates and sheets	183,061	12,820,340
Tin plate and sheets	43,407	6,436,047
Bars, rods, hoops, etc.	147,726	12,771,836
Structurals	184,813	11,142,997
Rails and connections	14,059	774,985
Pipes and fittings	1,277	90,879
Nails and spikes	2,359	228,580
Forgings, castings	19,935	3,325,859

Exports from Canada include:

Harvesters and binders	$2,773,756
Mowing machines	918,635
Cultivators	638,741
Ploughs and parts of	2,833,743
Gasoline engines	1,184,664
Locomotives and parts of	5,874,091
Wire nails	1,302,413
Other machinery and parts	5,852,327
Bars and rods (52,191 tons)	3,394,894
Rails (30,737 tons)	1,297,836
Structural (5,515 tons)	465,989

Imports in lines of iron, steel and machinery show:

Cream separators, steel bowls, and other parts	$1,238,657
Harvesters, self-binding	307,907
Ploughs and parts of	1,794,736
Threshing machines	822,819
Plough plates, mould boards, or shares, land sides, cut to shape from rolled plates of steel, but not moulded, punched or made	417,711
Automobile engines	5,586,127
Gas and gasoline engines	1,751,824
Gas and gasoline engines, n.o.p.	2,324,604
Castings, malleable, n.o.p.	334,325
Castings, iron, n.o.p., not malleable	1,037,744
Adding machines	783,361
Air compressors	225,622
Electric motors	1,387,834
Paper mill machines	1,004,990
Rolling mill machines	582,422
Other machinery of iron or steel, n.o.p.	16,353,427
Power lathes	402,473
Rolled iron or steel and cast steel in bars, bands, sheet or plate	4,298,705
Bar iron or steel	2,274,770
Iron or steel plates, coated with tin—"tin plate"	6,436,047
Iron or steel plates, 30" wide, not less than ¼" thick, n.o.p.	1,618,099
Iron or steel sheets, polished or not, No. 14 gauge and thinner, n.o.p.	2,831,411
Skelp iron or steel, sheared or rolled in grooves, for making wrought iron or steel pipe	4,139,860
Iron or steel angles, tees, beams, not punched	1,480,205
Iron or steel angles, beams, channels, etc., not less than 35 pounds per lineal yard	3,405,724
Iron or steel beams, sheets, plates, for ships or vessels	5,389,766
Pig iron	1,022,871

Iron Blast Furnaces in Canada, in 1919

Dominion Iron & Steel Co., Sydney, C.B.: Six completed furnaces; one of 350 tons capacity and five of 250 tons capacity each per day; No. 1, operated 309 days; No. 2, 214 days; No. 4, 237 days, No. 7, 126 days; two furnaces idle throughout the year.

Nova Scotia Steel & Coal Co., Ltd., New Glasgow, N.S.: Two stacks and one set of stoves at Sydney Mines, C.B., of 250 tons capacity; stack No. 1, operated 156 days.

Londonderry Iron & Mining Co., Ltd., Londonderry, N.S. (in liquidation): One furnace of 100 tons capacity idle throughout the year; not operated since 1908.

Midland Iron & Steel Co., Ltd., Midland, Ont.; Acquired in 1918 the Midland blast furnace plant of Canada Iron Foundries, Ltd., of Montreal, Que. One furnace of 130 tons capacity at Midland, Ont., operated 215 days.

Parry Sound Iron Co., Ltd., Midland, Ont.: Acquired in 1918 the blast furnace plant at Parry Sound, Ont., formerly operated by Standard Iron Co., Ltd. One furnace 90 tons capacity rebuilt and operated 240 days.

Standard Iron Co., Ltd., Deseronto, Ont.: One furnace at Deseronto with a daily capacity of 60 tons, operated 160 days.

The Steel Company of Canada, Ltd., Hamilton, Ont.: Two furnaces, one of 260 tons capacity, operated for 341½ days, a second furnace of 430 tons capacity operated 285 days.

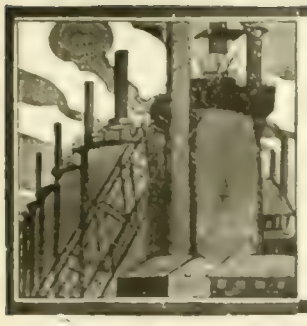
Algoma Steel Corporation, Ltd., Sault Ste. Marie, Ont.: Four furnaces at Steelton, near Sault Ste. Marie, two of 300 tons capacity each; one of 500 tons, and one of 400 tons. No. 1, in blast 285 days; No. 2, 364 days; No. 3, 171 days, and No. 4, 141 days.

The Atikokan Iron Co., Ltd., Port Arthur, Ont.: One furnace of 175 tons capacity idle throughout the year, not operated since 1911.

The Canadian Furnace Co., Ltd., Port Colborne, Ont.: One furnace of 325 tons capacity operated 363 days in 1919.

Canadian Steel Corporation, Ojibway, Ont.: Two stacks under construction, at the end of 1919 foundation had been completed for two blast furnaces of 550 tons each.

"Railroad and Locomotive Engineering":—This isn't much of a railroad story, but it is mechanical enough to pass muster, and it is aptly illustrative of some parallel things that were done during the joy-inspiring period of government control. Things were pressing in France and the ordnance department in a certain city were ordered to gather together all pulleys possible and ship them forthwith. As no ordinary pulleys were obtainable a telegram was sent to Washington that they could not get any ordinary pulleys but they could get a quantity of split pulleys. Whereupon a prompt reply was sent from the supreme ones at Washington: "Ship the split pulleys, if they are not too badly split." There seems to be no place in the world so sure to harbor incompetents as some of the upper reaches of government appointive service.



MARKET DEVELOPMENTS

Prices Firm in Steel and Machine Tools

Makers Claim There is No Advantage in Quoting a Lower Price as Buyers Are Not Ready Yet—Small Production Tends to Keep The Price Up—Steel Prices Are Also Well Maintained

BUSINESS has not improved in the iron, steel and machine tool market during the week, nor are there indications of any immediate recovery. This is stating the worst at the outset, because several dealers report that they have some encouraging inquiries now that should result in business later on.

The New York tool market does not look for immediate reductions in prices. Makers are putting through such a few machines now that their costs are going up instead of down because the few tools going through have to bear the overhead which was formerly distributed over a much larger number. Neither does the Pittsburgh market look for much in the way of reduction in the prices of steel. Only in a few cases does it seem likely that 1921 will have a better price than that which is now quoted. The Corporation mills continue to produce well, while many of the independents are down.

The steel warehouse business is rather quiet in Canadian centres, and great care is being exercised by buyers generally. Even boiler tubes, which generally sell very freely at this season of the year, are being taken on only for pressing repairs, and several cases are reported where the policy of "making it last" is being pursued.

Small tools are also being bought sparingly, and users are getting them only as they are needed. Railroads have been placing some orders in this line during the week.

The scrap metal dealers are getting no new orders and what business they are doing is simply on filling old contracts. Buyers, they claim, are taking opportunity of every defect in a car to refuse delivery, while in times when things are going well and the material is wanted, nothing is heard about such defects. Prices which dealers would pay for old material are down again this week, but it makes little difference as there are no consumers in the market at any price.

"WATCHFUL WAITING" IS THE ATTITUDE OF MANY BUYERS

Special to CANADIAN MACHINERY.

MONTREAL, Que., Jan. 13.—Mists of uncertainty still enshroud the industrial atmosphere, and until these have cleared away the sunshine of activity will be prevented from giving light to many who are now striving to see the return of the normal business day. On nearly every hand one sees the waiting attitude, everyone apparently deferring buying until lower prices have been announced. What is really expected in this direction it is hard to define. Many expect to see a drop in a week from a position which required years to reach. To avoid serious consequences it is necessary that any adjustment to pre-war, or even near it, must take many months before a satisfactory and healthy condition can be attained.

Gradual Improvement Looked For

While there are those in the trade that think prices on steel lines must be further reduced before consumers will be influenced into buying on an extensive, or even a moderately liberal basis, many of the dealers state that it is not likely that present quotations will be materially changed for some time. "Prices are about as low as they can go. Some slight reductions may be made in some lines, but nothing to speak of. Selling prices are based on cost of production and present quotations are as low as existing circumstances will permit." The dealers further stated that it could not be expected that trade would show any marked change so early in the year, and, as a matter of fact, they did not anticipate any heavy buying for several weeks. The statement of another merchant indicated that trade, though far from brisk, was nevertheless of an encouraging character. The stock on hand was possibly less than normally carried, but much of it was purchased at figures higher than those now obtaining. This is especially true in regard to high speed steels. "We have some in stock now that cost us a dollar a lb. and we would willingly dispose of it at 75 cents. There is very little demand for this steel at the present time. The movement of carbon and cold-drawn steels is fair, but below that usually recorded at this period of the year." Before purchasing new stocks the merchants are adopting every means to liquidate existing supplies, even though it be accomplished at a loss. As one dealer remarked: "It is better to take a small loss now than a greater one later on." It is the merchant that has been unfortunate in having a heavy supply on hand that must take the heavier losses, but the logical thing is to get rid of the material as soon as possible, so as to be in a position to take advantage of the market when the low level has been reached. Local price quotations are relatively the same, the high rate of exchange acting as a barometer in maintaining these at the comparatively high levels.

Prices Still Declining

Buying is still quiet in machine tool circles, but some dealers report an improvement over that of recent weeks. While the greater volume of business is done in small equipment, the movement of heavy tools is not dead. One dealer stated that he made quite a large deal last week, including some heavy tools. However, many factories are still operating light and taking on only such equipment and supplies as will tide them over the immediate future. Other plants have

resumed activities, on a conservative basis truly, but sufficient to create increased interest from the dealer's standpoint. The situation is still marked by declining prices in many commodities, and a falling market has seldom been a lodstone to draw out the buyer. Manufacturers are making inquiries, but actual sales are only made when materials are urgently needed. "We are not carrying heavy supplies of any kind," remarked a dealer. "We do not intend to, nor would it be advisable until a sounder working basis has been established. We have often found that on a falling market the purchase of material for stock has resulted in a financial loss before the goods are finally disposed of. For this reason we are only stocking sufficient supplies to cover the present requirements of our customers, which, for some weeks, have not been very great. Before May, however, we expect that conditions will have shown considerable improvement."

Light Business With Prices Firm

The metal market enters on the second week of the year with conditions about as they have been for the past several months, with buying restricted to actual requirements and business light in nearly every line of activity. Warehouse stocks in this district are generally sufficient to meet only the immediate needs of the trade and few dealers have been caught with heavy supplies on hand. "Speaking generally," remarked a dealer here, "we believe that metals have attained the lowest possible level that can be reached under the present order of things. This is particularly true in regard to ingot metals, but in the case of semi-finished materials some further adjustments may take place, but this will be governed by future developments. In the case of virgin metals the adjustment was brought about much sooner than in other lines, due largely to the additional volume of labor involved in the manufacturing processes of semi-finished and finished products. It is a little premature to predict the trend of the year's activities, as nothing tangible has yet developed to give a definite tone to trade conditions, but it is safe to say that, apart from slight fluctuations, the metal situation will continue firm, if it does not take on additional strength." The copper market has become steadier, with a slight upward trend in prices. The uncertainty of the past few weeks has been replaced by a confident belief that prices in this metal have reached the bottom and early reports may indicate a rise in price quotations. Spelter and lead show a slight decline on a poor demand, the quotation of 8 cents for spelter and 7¼ cents for lead representing a drop of ½ cent and ¼ cent per lb. respectively.

POINTS IN WEEK'S MARKETING NOTES

New York machine tool dealers are of the opinion that price reductions are not likely to come until there is a greater volume of business in sight.

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Scrap metal prices were marked down farther in some lines this week. Dealers are not getting any new business and nearly all of the trading that is taking place is being done on old contracts.

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The complaint is still heard in several different lines, that contracts are being cancelled without any fair explanation. Many of these cancellations are not being accepted.

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The automobile industry has sent word to one or two large shops, intimating their renewal of shipments on contracts which had been suspended for some time.

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Pittsburgh claims that steel bars averaged 1.40c in the ten years 1904 to 1913, and were down to 1.05 in December of 1914. The presetn price is 2.35 at corporation mills. It is intimated that the market may find its real basis at 2 cents.

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Most of the steel warehouses in district claim that they have gone through the high price stage safely, and are not too heavily stocked at the present time.

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Boiler tubes are moving at a very ordinary rate for this time of year by being rather lighter than usual.

BUYING DONE IN CONSERVATIVE WAY

Yards in Steel Business Looking Over Records Find They Have Little High Cost Stuff

TORONTO.—Buyers are going ahead very carefully in any section of the iron, steel or machine tool market that one cares to consider—in fact, there are a number of the dealers who will dispute the words "going ahead" in this connection at all. It is easier, many firms report, to secure money for any legitimate undertaking than it was three months ago, but as in other times it is harder to get any buying movement under way.

It goes back to the position in which the manufacturer finds himself. He is still asked for a high price for anything he wants to secure in the way of raw materials, and he is curtailing his programme to conform to known and definite wants. He is not going to be caught again with a lot of high price stuff in his warehouse that he will have to write off.

Encouraging reports are coming of the re-starting of several of the firms that have been closed for the holiday season, and some of them for some weeks before. Some of the automobile shops are ready to open up in a small way as a starter, and expect that once they get under way they will be able to go ahead again and work up to capacity before many months pass.

The Steel Market

Some of the merchants in the steel industry are busy now fixing up their own business for the year. It has been a time of reckoning for some of them to find out just how they stood in the matter of having cleared out their high-price material. Some of them have bought quite heavily from premium mills during the past eight months or so, and the getting of this material out of their stocks before the price broke was a matter of no small concern. Most of them, from what Machinery can learn, have come safely through the business, and have been able to keep their prices coming down to market levels by the mixing of high and low price material.

Boiler tubes should be better than they are now. Even in this line, on which deliveries are not too good, but buying is being cut closer than ever, and in some cases where in ordinary times repairs would be made, it is being allowed to "get along" for the present.

Merchant bar material is not moving in much volume. The open season may have helped a little, but for the present buying is small and for immediate requirements only. Some of the larger agricultural makers seem to be rather conservative in their programmes, and are not taking on the stock they generally are at this time of the year.

There is a fair business being done in sheets, and no change has been made in price. Plate is not called for extensively just now, and can be secured readily from existing stocks.

The Steel Contracts

One of the steel merchants in discussing the keeping of contracts and the adoption of the policy that "A Bargain Is Binding," claimed that this could be made effective only when both sides to the contract were making a serious effort to live up to it. "During the past year," he claimed, "we were under a so-called contract with the mills to buy from them, shipment to be made at their convenience. When it comes down to real facts, this business of mill convenience never arrived, and we got no material at all during the time when we were very much in need of it. As a

general thing, the keeping of contracts should be insisted upon, but the contract in the first place should be of such a nature that it is not a jug-handled affair that simply binds the buyer not to send his business to any other mill, without giving him a corresponding assurance that he will get as good service as he can get elsewhere."

The Scrap Market Dull

The scrap market showed a little life this week in fact enough to stimulate one of the dealers to rise up and mark down the list we have been publishing for some weeks past. Zinc, heavy and tea lead, aluminum, heavy melting steel, malleable scrap, No. 1 machine cast iron, car wheel, machine shop turnings, stove plate and cast boring were all marked down to lower levels.

There is very little business being done, and all that is under contract, with no new contracts being made. When old contracts run out there is nothing being done to renew the tonnage they represent.

Buyers are more particular now than they have been for many months, is the way one dealer sized the thing up. He claimed that instead of cancelling contracts, they came about it another way in a good many cases. Were there anything wrong at all with a car of scrap metal, the thing would be rejected outright. Many of the buyers were doing this because they did not want to take on the tonnage for which they contracted, neither did they want to come out and try for a cancellation. In ordinary times, or when the material was much wanted, there would not even be a complaint over a car that calls for a reject now. This dealer was certain that some of the users were going over the cars with a fine comb and a glass looking for defects or departures from classification.

STEEL PRICES WELL MAINTAINED BUT SOME LINES MAY COME DOWN

Special to CANADIAN MACHINERY.

PITTSBURGH, January 13.—Production of steel ingots in December was at the rate of about 31,000,000 gross tons a year, this comparing with a rate of about 36,300,000 tons in November and an average rate during the first nine months of 1920, when demand was very heavy, but when there were very serious operating difficulties, of about 42,000,000 tons. The actual production in 1920 was 40,000,000 tons or a shade more.

Actual capacity of the industry, given reasonably favorable working conditions, such as always obtained prior to November, 1916, but which have been very rare since then, is about 52,500,000 tons or about 22,500,000 tons for the Steel Corporation and 30,000,000 tons for the independents. The mills did not operate in December in these proportions by any means, as the Steel Corporation still had good order books and indeed increased its operations slightly, by reason of having greater supplies of coke, while the independents had almost run out of orders. The corporation operated in December at about 92 per cent. of capacity and the independents at about one-third capacity. As nearly as can be estimated, in December the Corporation produced ingots at the rate of about 21,000,000 tons a year, while the independents produced at the rate of about 10,000,000 tons. Independent mill operations have been declining continuously and thus are now at a materially lower rate than the average of December, probably between 20 and 25 per cent. of capacity or at 6,000,000 to 7,500,000 tons a year.

The greatly different positions of the Steel Corporation and independents is shown in another way by the record of blast furnaces. In December independent steel works and merchant furnace interests blew out 55 blast furnaces and blew in none, while the Steel Corporation blew out only one, and blew in five.

Production Prospects

At the present moment steel ingots are being produced at the rate of about 28,000,000 tons a year. Of course, one would like to see prospects of the rate of production beginning to increase at once, but obviously that cannot be expected. In the first place, buying is very light, indeed, while from day to day old business is being completed. In the second place, a rate of 28,000,000 tons is precisely two-thirds of the 42,000,000 ton rate that obtained during the first nine months of 1920. Nobody can be so ignorant of general conditions existing, as compared with those in the major part of last year, to believe that the rate of steel consumption is decreased by only one-third. Finally, it is known that some of the steel now being shipped to dealers and consumers, and being accepted willingly by them, is not being consumed. The steel is accumulating. Obviously these buyers will not, for any length of time, continue to accept more steel than they are consuming.

Hence further decreases in production of steel may be expected. The question is when increased buying will have proceeded far enough to take up the slack and convert decreasing production into increasing production. In well posted and conservative quarters it is confidently predicted that there will be a decided improvement in buying of steel products some time in March, more likely in the second half of the month. It may not be until some time afterwards that the rate of steel production will be back to the present rate, but it would not require much to put the industry in better shape than it is in at present.

Prices Present and Prospective

Steel prices may be described as being well maintained, but that is really not saying much since so little business is moving that there is scarcely any opportunity to cut prices. It may be said, however, that most mills are altogether averse to cutting prices. It was one thing for the independents to reduce their prices to the Steel Corporation level. It would be another thing altogether for them to cut the Steel Corporation prices. The independents would of course like to operate their plants in full, but there is no chance of their being able to do any such thing for the present. A good way to put in the time is to reduce production costs, and a period of idleness is not altogether objectionable, having some advantages. Undoubtedly there will be competition between some of the smaller mills, resulting in price cutting, but there will be none of this on the part of the Steel Corporation or several of the large independents.

A fairly steady market, therefore, is to be expected for some time to come, perhaps for only a few weeks, perhaps for several months. Eventually, without doubt, prices will be lower. Some manufacturers virtually admit this. Others do not, but that is presumably from policy or habit. There is ample proof that steel prices will be lower. As noted above, production during the first nine months of 1920 was at the rate of about 42,000,000 tons of ingots a year, and that was only 80 per cent. of capacity. A greater output could not be realized because there were physical difficulties in the way, the chief of which was shortage of fuel. Thus to employ the full capacity consumption would have to be one-fourth greater. It cannot be argued that physical disability will stand in the way, for when industry becomes active again it is going to be on an efficient basis. There will not be a full demand unless everything is functioning smoothly. It is a settled fact in the present readjustment that in future all industries will have to be content with moderate profits. When the Steel Corporation operated at well under capacity in 1920 it reported large profits, and practically everyone is convinced that the accounting methods were so conservative that the profits were really larger than were reported. Accordingly, very large profits would be yielded on present prices with full operation and with the reduction in costs from the present level that is now regarded as certain. Hence selling prices will be lower, but they will hardly be lower until costs have been reduced and until there is prospect for a moderately full operation of industry. Merchant

teel bars, the most prominent product f the steel industry, averaged 1.40c in he ten years 1904 to 1913 and were lown to a minimum of 1.05c in Decem-er, 1914. The war control price was 2.90c and the present price, that of the Industrial Board and of the Steel Cor-poration, is 2.35c. According to wheth-er the reduction in costs is mild or dras-tic, and the wait for large orders to be offered is short or long, the steel bar market will probably turn on either about 2.00c or 1.80c. Of course, definite predictions as to actual quotations cannot be made, and figures are mentioned here merely to assign a definite measure to the estimate of the forces that will be at work.

TOOL DEMAND TOO LOW TO PERMIT OF ANY LOWER COSTS

Special to CANADIAN MACHINERY.

NEW YORK, January 13, 1921.—While so far as the machine-tool trade is concerned there was little indication of improvement in business in the first week of the new year, there were a few marked instances of betterment in the general business situation, which was reflected in a more hopeful feeling in machine-tool circles. Other lines of industry must recover from the depression before the buying of machine tools on a fairly normal basis can pick up. There is a slightly better inquiry for tools, but orders are still extremely scarce.

One reason for the improvement in the general business situation is that prices of many basic commodities are believed to have touched bottom. In some instances they are down to or below the pre-war level, and buyers are showing a little more confidence in placing orders. Moreover, the liquidation in retail stocks is now going on more rapidly, and this will be reflected soon in orders for jobbers and manufacturers in various lines.

The price situation is one that is somewhat disturbing to the machine-tool manufacturers. Buyers point to the fact that the liquidation which has gone on in other industries has, as yet, scarcely touched the machine-tool industry. It is true there have been some price reductions, but the majority of tool manufacturers are not reducing prices and have no apparent intention of doing so at present. Some of them say that when a sufficient amount of business comes into sight to justify lower prices they will consider making them; others say that there must be considerable reduction in their manufacturing costs before they will reduce prices. While pig iron and steel are cheaper, any saving thus effected by the machine-tool manufacturer is more than offset by the present low production. As fewer machines are being turned out each machine must stand a larger proportionate part of the general overhead.

Some machine-tool manufacturers have assured their machinists and other highly skilled mechanics that there will be no reduction in their wages. It is recognized that skilled machinists did not receive before the war a wage commensurate with their skill and the time required by them to learn their trades. There seems to be a general disposition to accord machine shop artisans a better wage than they received before the war.

Taking all of these factors into consideration the prospect of a very large reduction in machine-tool prices does not seem encouraging from the buyer's viewpoint. Just how the situation will work out is for the future to determine. It seems improbable that there will be many price reductions while the demand for tools is at its present low point.

PIG IRON TRADE

Although the pig iron market entered the new year at a low ebb, the feeling among dealers is inclined to be optimistic.

A prominent valley producer in the Pittsburg district announced at the open- of business this year that they were willing to sell basic pig iron at $30 valley, and bessemer and malleable at $32 valley. No sales of consequence are reported. There have not been enough sales of foundry iron to have a clear cut market but some furnaces would sell at $33 or less.

A number of inquiries have appeared this week on the Cincinnati market, and hope is held out that the slump will soon be over. There has been a withdrawal of some of the resale iron which was glutting the market.

On the Birmingham pig iron market, release orders have been encouraging, but they still fail to cover much of the help up tonnage.

There is a more optimistic feeling on the Buffalo market. It is believed that buying will soon become active though furnace operation is no livelier. No. 2 plain 1.75 to 2.25 silicon is quoted at $34 to $35 f.o.b. Buffalo and basic at $36.

New York has practically a lifeless market. Resale iron continues to be an important factor.

Furnaces in the Cleveland district have started the new year with a large tonnage of last half iron carried over on their order books. Pig iron will be further curtailed in this district by the shutting down of the Ford Motor Co. [illegible] out during the week.

[illegible] though small, are more numerous and the passing of the old year resulted in the withdrawal of some resale offerings. Both these facts give the market a more cheerful tone.

TO START WORK ON THE CONTRACT

Ontario Firm Will Begin on Work For Auto Concern That is Restarting

The announcement that the large motor concerns in Detroit are again manning up with the purpose of resuming operations is not without a note of encouragement to Canadian manufacturers.

The manager of a large plant in the Niagara peninsula told Canadian Machinery that a large order on which cancellation had been refused as far back as September had been practically ordered resumed, and that a representative of the motor parts institution concerned was calling on all plants interested in Western Ontario, advising them that orders would stand and at prices agreed upon.

It would appear that busy times are not far distant. Reports from Detroit indicate that car orders are coming in in fine volume.

CUT THE WAGES IN STEEL MILLS

Big Firms Make Reductions That Will Amount to 25 Per Cent.

JOHNSTOWN.—R. M. Custer, vice-president of the Cambria Steel Company, has announced a reduction of wages amounting to 25 per cent., and that all but a few of the smaller departments will be closed down for at least two weeks.

Extensive declines in the selling prices of iron and steel made necessary the wage reduction, according to notices posted on all bulletin boards in the big plant. These notices said that all Cambria workmen, whether employed by the hour, day, turn, tonnage or piece work, are included in the wage revision, as well as all salaried employees.

Executive officers of the principal independent steel company here, when informed of the wage readjustment in the mills of the Cambria Steel Company at Johnstown, frankly stated that drastic [illegible] Pittsburgh mills.

[illegible] there could be no stability in the steel market, and it was proposed to bring [illegible]

SYDNEY.—A 20 per cent. cut in [illegible] announced by the Dominion Iron & Steel Co. The reduction will affect approxi- [illegible] are temporarily laid off.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$39 96
Lake Superior, charcoal, Chicago	53 50
Standard low phos., Philadelphia	44 79
Bessemer, Pittsburgh	41 96
Basic, Valley furnace	37 50
Toronto price:—	
Silicon, 2.25% to 2.75%	51 50
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 50
Steel bars, base, Montreal	4 50
Reinforcing bars, base	5 50
Steel hoops	6 00
Tire steel	5 00
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 50
Chequered floor plate, 3-16 in.	8 50
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross. Montreal	Toronto
Lake copper	$19 00	$19 50
Electric copper	18 50	19 00
Castings, copper	18 00	19 00
Tin	44 00	46 00
Spelter	8 00	9 00
Lead	7 25	8 00
Antimony	8 00	9 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 5 50	$ 5 50
Plates, ¼ up	5 00	5 50

PIPE—WROUGHT

Standard Buttweld Pipe
Per 100 Ft

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv
⅛	$ 6 50	$ 8 50	$	$ ....
¼	5 81	7 41	6 91	8 01
⅜	5 81	7 41	6 91	8 01
½	7 16	8 63	7 95	9 48
⅝	8 80	10 87	9 98	12 02
¾	13 01	16 97	14 71	17 77
1	17 60	21 74	19 90	24 01
1¼	21 04	25 99	23 79	28 74
1½	28 31	34 97	32 01	38 67
2	44 75	55 28	....	....
2½	58 52	72 29	....	....
3	74 06	90 62	....	....
3½	87 75	107 37	....	....
4				

Standard Lapweld Pipe
Per 100 Ft.

	Steel Blk.	Steel Galv.	Gen. Wrought Iron Blk.	Gen. Wrought Iron Galv
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger, 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%.
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.
Per 100 Pounds.

	Montreal	Toronto
Copper, light	$10 50	$10 50
Copper, crucible	13 00	12 00
Copper, heavy	12 50	12 00
Copper wire	12 50	12 00
No. 1 machine composition	13 00	12 00
New brass cuttings	7 00	9 00
Red brass turnings	10 00	10 00
Yellow brass turnings	7 00	7 50
Light brass	5 00	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	4 00
Heavy lead	5 25	4 00
Tea lead	2 50	2 00
Aluminum	16 00	13 00

	Per Ton	Gross
Boiler plate	$11 00	$12 00
Heavy melting steel	18 00	16 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	20 00	20 00
No. 1 machine cast iron	32 00	28 00
Pipe, wrought	8 50	10 00
Car wheel	30 00	30 00
Steel axles	20 00	18 00
Mach. shop turnings	8 00	7 00
Stove plate	23 00	23 50
Cast boring	8 00	10 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜-in. and less	Net
Coach and lag screws	20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	5
Machine bolts, ⅜-in. and less	30
Blank bolts	Net
Bolt ends	5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	+25 add $2 0
Nuts, square, tapped	add 2 2
Nuts, hex., blank	add 2 5
Nuts, hex., tapped	add 3 0
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and
Boiler rivets, base ¾" and larger	$8 5
Structural rivets, as above	8 4
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws —20% 25 and	5
Sq. and hex. hd. cap screws	12½
Rd. and fil. hd. cap screws plus	25
Flat but. hd. cap screws plus	50
Fin. and semi-fin. nuts up to 1-in.	12½
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	—5
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	+12½
Studs	+5
Taper pins	—12½
Coupling bolts	+40
Planer head bolts, without fillet, list	+45
Planer head bolts, with fillet, list plus 10 and	+55
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	+60
Collar screws list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add +85
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	$5 75
Cut nails, vase	6 70
Miscellaneous wire nails	50%

ROPE AND PACKINGS

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 29
British Manila rope	0 28
New Zealand hemp	0 23

POLISHED DRILL ROD

Discount off list, Montreal and Toronto net

MISCELLANEOUS

Solder, strictly	$ 0 27½
Solder, guaranteed	0 29½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	15 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal.	3 15
Linseed oil, raw, single bbls.	2 37
Linseed oil, boiled, single bbls.	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	40 and 5
Can. carbon cutters, plus	10
Standard drills, all sizes	40 and 5
3-fluted drills, plus	10
Jobbers' and letter sizes	40 and 5
Bit stock	50
Ratchet drills	10
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers, carbon	50
Centre reamers	5
Chucking reamers	net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7.50 base
Hexagons and flats	7.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	85
Class B	30	40
Class C	20	30

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 00
Sheets, blue ann., No. 10	7 00	7 50
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	13 00	....
Fleur-de-Lis, 28 B.W.G.	12 50	.....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	10 00	11 00
Premier, 10¾-oz.	10 50	11 40
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No 1 OAK TANNED

Extra heavy, single and double	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ⅛ in. to 1 in. rod	0 30
Brass sheets, 24 gauge and heavier, base	0 38
Brass tubing, seamless	0 42
Copper tubing, seamless	0 44

WASTE

XXX Extra	.23	Atlas	.19
Peerless	.22	X Empire	.18½
Grand	.21½	Ideal	.18
Superior	.21½	X Press	.17
X L C R	.20		

Colored

Lion	.16	Popular	.12
Standard	.14	Keen	.10
No. 1	.14		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White.20 Dark colored.09
Mixed colored.10

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$35 00	$37 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	40 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	43 00	46 00
Copper sheet, planished, 16 oz. base	47 00	50 00
Braziers', in sheets, 6 x 4 base	39 00	42 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 50	$14 50
Sheets, 3½ lbs. sq. ft.	10 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.04¾
Acid, nitric	.11
Acid, sulphuric	.04½
Ammonia, aqua	.15¾
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.16
Copper, carbonate, annhy	.41
Copper, sulphate	.13
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.20
Nickel carbonate	.32
Nickel sulphate	.20
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lbs	9.00
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

$150,000,000 in Steel From the U.S. to Canada

Lloyd Harris Brings Up an Important Point in Address at London—What Has Been Done Along These Lines to Make Use of The Canadian Iron Ore Deposits?

LONDON,—Lloyd Harris, of Brantford, addressing the Canadian Club at a banquet at the Tecumseh House, announced that Canadian scientists have succeeded in developing a method by which Canadian refractory ores can be treated. He explained that, because of the difficulties of ore treatment and the fact that practically all coal now comes to Canadian mills from American mines, numerous experts had reported that the Dominion has not the basis for a steel industry. This country, he said, imports $150,000,000 worth of steel from the United States every year, and as a result the difficulties of exchange are rendered more acute. Efforts are now being put forth to devise some method of standardizing steel forms so that Canada's wants may be supplied at home. To this end an Australian system of standardization is being studied.

Use Electric Furnace?

In connection with this matter, Canadian Machinery put the matter up to several men who have experimented largely with the electric furnace. W. F. Sutherland, who has worked in conjunction with James W. Moffat, M. E. I. C., answered the point on the reduction of iron ores, as follows:

In the manufacture of steel, the electric furnace has won a place its many advantages justly entitle it to, but in the field of ore reduction past processes and equipment have not proved commercially successful unless under exceptional circumstances. This is due to a number of causes, chief among which is the inability of any of the processes to make steel directly from the ore with any degree of uniformity or economy. And while in many cases a varying amount of carbonaceous material, coke or charcoal has been saved the extremely large amount of power required has more than counterbalanced any saving in fuel.

The reduction of iron ores in the blast furnace is a process which is fairly well understood to-day and with its adjuncts, the blast furnace is a comparatively cheap mechanism to run. The carbon monoxide content of the gases given off in reduction is of use in preheating the blast and also for the furnishing of power to steel mills and other portions of the plant not directly connected with the blast furnace itself.

The consumption of fuel in the blast furnace is however high in that approximately three to four times as much fuel is charged as is required to supply the reaction heat, the remainder being used to heat the charge, melt the slags and metal and besides unavoidable losses, heating the large amount of air which has to be supplied. This latter item is a very considerable one and may be set down almost as a total loss.

More Need for Economy

With the ever mounting price of coal and its resulting coke, fuel economy is very important, particularly so where suitable coking coals are either nonexistent or scarce. For this reason it is to be expected that direct processes, saving in coke and using electrical energy for certain stages of the process should meet with favor.

An important advance both in ferrous and non-ferrous metallurgy has recently been made in a process devised by James W. Moffatt, M.E.I.C., of Toronto, Ont., and the production of iron and, steel from ore direct, has been brought appreciably nearer solution.

In this process for which patents have been obtained in the United States, U.S. Patent No. 1,294,514, and principal foreign countries use is made of two separate and discontinuous step in two separate types of apparatus. The ore is first finely ground and if necessary concentrated and is then charged into a reduction furnace. Here the carbonaceous reducing material is added and reduction to iron sponge or finely divided and porous metallic iron takes place. This sponge is then charged directly into an electric furnace of the ordinary type and is there melted down by electric heat. In this melting down the electric furnace is used through the certainty with which a reducing atmosphere can be obtained and through the desirable qualities of the steel or other metals obtained by its use. The duplexing of the electric furnace with the reduction furnace and the avoiding of the re-oxidation of the sponge in its transference from the one to the other are the basic features of the process patents obtained. Particular stress is laid on the prevention of re-oxidation since nearly all metals in a reduced and finely divided state will oxidize very readily at even moderate temperatures.

Cheaper Than Open Hearth?

The process as worked out in practice lends itself to economical results and is quite comparable to other present day methods in this respect. Given the right conditions it is possible to produce steel more cheaply than can be done in the open hearth.

This economy is obtained in great measure through a reduction furnace which has also been patented by Mr. Moffat, U.S. Patent No. 1,348,889. As mentioned above the blast furnace requires a very considerable volume of air for its continued operation and much heat is lost through the escaping of gases of which the nitrogen in the air forms no inconsiderable amount. In the present reduction furnace the carrying on of reduction and the supplying of the heat for the reaction are kept separate. The reduction is carried on in a retort heated on the exterior and the gases given off consist entirely of carbon monoxide with a certain percentage of carbon dioxide only. They are thus of high heat value and containing no diluents such as nitrogen are comparatively rich and of smaller volume. Theoretically the amount of carbon monoxide given off is sufficient in its heat value when burned to supply the heat necessary for the carrying on of the reaction and in the present instance provision has been mode for their utilization in this manner. In practice a small amount of heat has to be supplied from another source, but the total fuel consumption is limited to a slight excess over the theoretical amount required for reduction together with the small amount of auxiliary fuel. The reduction of the ores by this method will show a very much decreased cost for fuel when compared with the blast furnace.

Can Be Charged Hot

By the using of the more expensive electrical heat in the final melting down only, a marked saving in power cost also results. The ordinary six ton electric furnace working on alloy or plain carbon steels, running two slags will have a power consumption of about 700 to 800 k.w. hours. In the present case a saving will be effected over this amount since the iron sponge resulting from the reduction operation can be charged hot.

Furnace operation is also smoother and, on starting each heat, inductive troubles with consequent lowering of power factor, and short-circuit conditions are absent.

An interesting feature of the process is its extreme flexibility. With carbon control as provided for, irons can be made varying from pig iron through high carbon steel to a practically carbon free metal of extreme softness. The reduction furnace is also capable of roasting operations and the elimination of sulphur is thus quite easily carried out. This feature is of advantage in the treatment of many ores unavailable at present except by roasting and a subsequent briquetting operation. Since in any case crushing is necessary for this direct process, concentration is easily carried out and a large number of ore bodies too lean for economical working

Continued on page 60

The Week's Events in Montreal Industry

Lieut.-Col. Gardiner, of Robt. Gardiner & Son, Montreal, who has been confined to his home for the last three weeks by illness, is now reported to be progressing favorably and sitting up, and it is hoped that he will soon make his reappearance down town.

Mr. Roy Wolvin, president of the British Empire Steel Corporation, is still in London, but is expected back in Montreal about the end of this month, and at that time it is expected he will have some announcement to make regarding the form which the merger will eventually take.

The Watt Machinery and Equipment Company are now well established in their new offices at 344 St. James St., Montreal. They have ample space for carrying large supplies and in a very brief time will be in a position to meet every requirement for machine tool equipment and sundry supplies.

The Angus shops of the Canadian Pacific Railway in Montreal have again resumed operation after a shut down of about ten days. It has been stated that work has been continued with the same staff as before the holidays, the number of employees now engaged being around 5,500. The wage scale remains the same as that in force before the suspension of activities.

The Holden Company, of 354 James St., Montreal, are distributing to the trade a very attractive calendar of the Chicago Pneumatic Tool Company. The calendar is printed on coated stock, 12 inches wide by 24 inches deep, the upper section of each page carrying a large reproduction of one of the applications of one of the company's air-operated tools. The entire calendar is neatly arranged and well deserving of a place in any engineering office.

At a recent meeting of the Montreal Automobile Association it was decided to change the name to that of the Montreal Motorists' League. The Board of Directors, under the leadership of president J. D. Chesney and Vice-president Malcolm LeMieux, are making efforts to increase the membership to 5,000 during the coming year. In the absence of T. C. Kirby, the secretary-treasurer of the Association, the duties of the office will be looked after by Director J. K. Blyth.

William Petts, travelling mechanical inspector of the Ocean Accident and Guarantee Corporation, died last week after a long illness. Mr. Petts was born in England 64 years ago, coming to Canada in 1882. He has occupied quite a number of prominent positions, his first here in Canada being foreman for the railway machine shops in Montreal. He was about 12 years with the Laurie Engine Company, and with the C.P.R. before entering the services of the Ocean Accident and Guarantee Corp.

A course of lectures on Industrial Chemistry will be one of the features of the present season at McGill. This series of addresses is designed to be of interest to anyone desiring scientific information applicable to their own occupations. The lectures will be conducted by specialists from Montreal manufacturing plants, and the talks will be as free as possible from technical language, and the subjects will cover chemical processes in use in plants manufacturing sugar, pulp and paper, paints and varnishes, Portland cement, steel, lead and other products.

Following the closing down of the large blooming mill of the Nova Scotia steel plant some three or four weeks ago, the remaining departments of the works suspended operations last week. The action of the management in this respect did not come as a surprise as the employees have been expecting some such move for the past three weeks, or since the stopping of the mill. With the exception of two spike machines and a few machines in the nut and bolt department, the entire plant will be closed for an indefinite period. In addition to affecting the workmen, it is stated that about seventy-five of the head office staff have been notified that their services will not be required after the last of this month.

A demonstration of specially designed tractors for the removal of snow from the city streets was given before the city commissioners of Montreal last week. The exhibition was given on the Champ de Mars, the three manufacturers demonstrating their machines being the J. T. Tractor Company of Cleveland, Ohio; the Cleveland Tractor Company of Montreal; and the Holt Manufacturing Co., of Peoria, Ill. The operation of the machines is on the same principle as the steam shovel, the work being accomplished by the caterpillar spikes breaking up the snow, and the weight of the tractor pushing it aside, the snow being then lifted and placed in cars or carts. One of the machines was so small that it could be worked to advantage on the ordinary sidewalk.

William Beardmore and Company, of Scotland, have opened a Canadian office at 385 Beaver Hall Hill, Montreal. This firm carries on an extensive business in many lines of engineering activity, manufacturing steel shaftings and forgings of all sizes types and axles, small tools, jigs and fixtures, locomotives of every description, lapwelded furnaces and flanging work of all kind. They also plates and sections, and complete boilers of every type and size. They are builders of steam, turbo, Beardmore-Tosi Diesel and Beardmore crude oil engines, centrifugal and semi-rotary wing pumps. They are also naval constructors, having built H. M. S. Raleigh and other war vessels. They are now installing a semi-Diesel crude oil engine of 320 B.H.P. in one of the new Hudson Bay vessels.

$15,000,000 IN STEEL

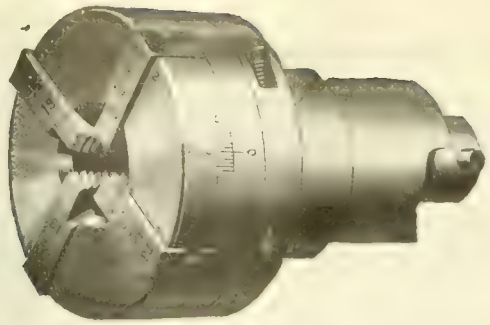
Continued from page 58

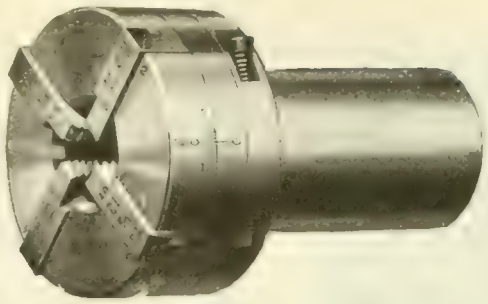
to-day will thus be rendered available With the depletion of the Minnesota and other high grade beds the leaner ores of the country will become of more importance in the coming decade and a process which can use concentrates without further treatment will thus be of much value in metallurgy.

The reduction of iron ore without fusion or its manufacture into sponge dates back into the dawn of the iron age. The primitive man probably first made it in his crude forges, and the Catalan forge, in common use in Europe until comparatively recent times, made a form of sponge. Later attempts at direct processes also made use of sponge iron to some extent but difficulties in the prevention of re-oxidation, together with the comparatively expensive nature of the processes, prevented their commercial success.

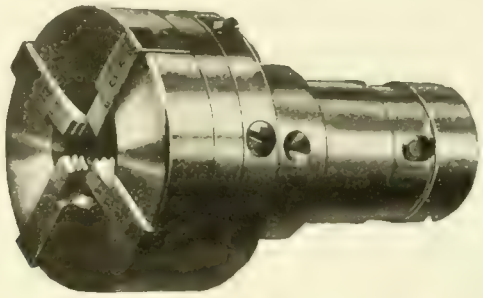
While the process will find its greatest field of usefulness in ferrous metallurgy it is equally adapted to non-ferrous metals and where such can be obtained in the oxide form, and are suitable for reduction by this means, their economical winning will be possible.

The successful outcome of fifteen years' research on the part of Mr. Moffat should prove of considerable value in the utilization of Ontario iron ores, many of which can only be successfully treated by means of concentration and, in the case of siderate ores, by calcination. It is interesting to note that only recently the utilization of domestic ores has received consideration at the hands of the Advisory Research Council and that Professor Stansfield has been carrying on research under grant from the council with the some end in view during a portion of the past year. Attention is drawn by Mr. Moffat to the fact that his patents are basic and cover any metallizing furnace in combination with any electric furnace for the production of iron and steel direct from ore by the sponge process.





Geometric Solid Adjustable Die Heads



When one uses the word "ONLY," he needs to be sure of what he is talking about. With confidence we use the word in saying that a Geometric Solid Adjustable Die Head, fitted with a set of milled dies, is the only solid die head that will back off without stripping the thread.

Geometric Solid Adjustable Die Heads may be fitted with either a releasing shank, plain shank, or with special shank for the Gridley Automatics. The releasing shank permits the head to disengage from the shank upon completion of the thread. The plain shank fits the head for use on the turret of a lathe or on a live spindle, such as a drill press.

Apart from the fact that it is not equipped with the self-opening feature or the roughing and finishing attachment, the Geometric Solid Adjustable Die Head is the same in principle and construction and will do equally as accurate work as the other styles of Geometric Die Heads.

Whatever the requirements, there is a type of Geometric Die Head best adapted to the work.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta
Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg; St. John, N.B.; Halifax, N.S.

If interested tear out this page and place with letters to be answered

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

EXPECT MORE TRADE IN 1921

Convention of the International Business Machines Finds Canada In The Lead

Optimism was the keynote at the Convention of the Canadian sales force of the International Business Machines Company, held at the offices of the Company, Royce and Campbell avenues, Toronto, in the week of January 3rd, 1921. "A fifty per cent. increase in business in 1921" is the task to which they have addresed themselves and not a few expressed the conviction that even this mark would be passed long before the close of the year.

About 75 salesmen in all were in attendance at the convention. They represented the three divisions of the company—International Time Recorders, International Dayton Scales and International Tabulating and Sorting Machines.

Figures presented at the convention showed that the Canadian organization held all sales records for 1920 against the sales forces of the American firms manufacturing similar products. In fact, the Canadian organization has led the entire world in sales, on percentage of quota, for four successive years.

The factory organization did itself proud in decoration to welcome the boys from the field. When the latter arrived from all parts of Canada—from Vancouver to Newfoundland—they were greeted by a group of pretty office girls, who pinned a buttonhole bouquet on each of their lapels, and who further had prepared a song applicable to each member of the sales force.

F. E. Mutton, vice-president and general manager of the International Business Machines Co., Limited, is proud of his sales force and advises that not only he, but the entire sales organization never were more optimistic as to the future.

The convention was addressed by Thomas J. Watson, president of the Computing Tabulating-Recording Co., of New York; Joseph E. Rogers, general manager of the Tabulating Machine Company, New York; A. H. Hastings, president of the Computing Scale Company of America, Dayton, Ohio.; D. C. Wells, general manager of the Moneyweight Scale Company, Chicago.

Monday evening, January 3rd, was spent at a theatre party at Shea's Theatre, and Tuesday evening Mr. Mutton gave an exclusive banquet to the members of the I.B.M. Club, comprised of men who lead the entire organization, at the King Edward Hotel. Wednesday evening was devoted to a supper dance to the entire organization at Masonic Hall, at which some novel vaudeville features added materially to the merriment. Friday evening closed the convention with a banquet at the King Edward Hotel.

AUTO COMPANIES TO REOPEN PLANTS

Men Being Taken on Gradually, Depending on Demand for Cars

Detroit.—That the renewed tendency of the public to buy whatever it needs is having its effect on Detroit industry was indicated Saturday, when the Liberty Motor Car Company announced it would renew production on a small basis January 17.

According to officials, the reopening of the plant is based entirely upon the demand for cars. Three hundred men will be put to work at first, and this number will be increased after the New York show, which is expected to stimulate sales.

Three hundred employees of the Chalmers Motor Company, laid off December 24, will go back to work Monday morning or some time next week, according to employment officials of the firm.

The Studebaker Corporation intends to open its Detroit plant on a three-day schedule Monday morning. A limited number of old employees will be given work, and a plan to build up to normal capacity from this nucleus has been adopted, said James E. Spencer, assistant to the vice-president.

For Gold Work.—Wayne Forge & Machine Company, Toronto, have just completed a special furnace for annealing gold. The gold in strip form, is fed in the furnace and comes out the back, the operation being continuous. This furnace is about seven feet in length. It was built to the order of a local jewelry manufacturer.

Trade Gossip

In New Premises.—Elliott & Whitehall, manufacturers of small tools, Galt, expect to be in their new building by Spring.

Put in Machine Shop.—The MacFarlane Enginering Co., Paris, have installed a well-equipped machine shop in connection with their foundry.

Starting in Kitchener.—The majority of the Kitchener industries will be in operation, after having been closed during the holiday season. With the exception of a few furniture factories, the industrial activities of the city will again be normal. Owing to the furniture exhibition here this week, most of the factories will remain closed until the seventeenth.

Re-open Plant.—The Studebaker Corporation of Canada, Limited, Walkerville, reopened on Monday morning with a force of 200 men, it was announced by Edward Mackie, plant superintendent. The company has retained 100 men during the inventory and will again take on another 100 men, all of whom were formerly employed. Married men will be given the preference in hiring back old employees.

British Trade.—Mr. T. R. Mason, a representative of a Sheffield steel concern who is visiting Canada to gain an intimate knowledge of the trade conditions here, said that Great Britain was reassuming and recapturing trade which it had lost during the war and was even going into new fields in the face of strong competition. Business gloom is vanishing in England, and within five years England will be farther ahead than it ever was.

Plants Re-open.—The Wabasso Cotton Company and the Tidewater Shipbuilding Company, at Three Rivers Que., reopened their doors after a week's shutdown. All the men were taken back. Wages were reduced 10 per cent. at the Wabasso. The St. Maurice Paper Company have reduced the wages of their lumber cutters to $60 and $75 per month. The shutting down of the Wayagamack Pulp & Paper Company's plant has been postponed for a few days. A poster advises the men that the plant will close its doors on or about the 15th of January for a short time. There will be no reduction in wages.

ENGINEERING

The National Castings Ltd., will build a foundry at Belleville, Ont.

A by-law for $75,000 for fire apparatus was carried at Fort William.

Ratepayers of Perth, Ont., carried a by-law for a new hospital there.

The ratepayers of Ford City, Ontario, have passed a by-law for technical school.

A by-law was carried to provide $135,000 for a new school for Terrace Hill, Brantford, Ont.

Tuttle-Bailey Mfg. Co., Bridgeburg, Ont., are making arrangements to enlarge their plant.

Alfred LePage, 1775 Georgia St. W., Vancouver, B.C., will erect a storehouse and machine shop.

The property owners of Kingston, Ont., passed a by-law to grant a site to the Kelley Driver Co.

Reynold Moore and Benz Co., Ltd., Higgins Ave., Winnipeg, contemplate the erection of a factory at Vernon, B.C.

The Electric Foundries Ltd., Tudhope Knox Building, Orillia, Ont., will build a foundry at a cost of $20,000.

London, Ont., is to have a Home for Incurables, and a new Children's Hospital. By-laws were passed by the ratepayers of $50,000 for each.

R. N. Irvine is to erect a three-storey building at 340-4 Yonge street, Toronto, for the Thornton-Smith Co. Estimated cost, $100,000.

Tenders will be called in March for the erection of an addition and alterations and improvements to the Sheldon Hotel, Blenheim, Ont.

The general contract for erection of a garage on Lansdowne Ave., Westmount, has been awarded to Fussing & Jorgensen, 6 Durocher St.

Niagara Glass Co., 40 King St., St. Catharines, have purchased the building at 220 St. Paul St., which they will alter to suit their requirements.

The Consumers Gas Company, 19 Toronto St., Toronto, are erecting an addition to their office building at a cost of $50,000. Work will commence shortly.

The Dominion Bridge Company have received the contract for steel in connection with the erection of a large hotel for the Mount Royal Hotel Company, Ltd.

The contract for the soldiers' pavilion and reception hospital at Selkirk, Man., [illegible] awarded to the Capper Hall Abbott Co., Ltd., Winnipeg, the price being $460,000.

Plans are being revised by Pratt & Ross, architects, Electric Rly. Chambers, for [illegible] to cost $15,000, for the Manitoba Motors Bldg., 293 Garry St., Winnipeg.

USING PROFITS TO WRITE OFF HOLD-OVERS FROM WAR YEARS

RE-ORGANIZATION of their business program to meet changing contions has occupied the attention of a good many firms during the past few weeks. A feature of the work has been the wiping out or writing off, or erasing from memory -whatever phrase suits best—of overhangs or adverse items that were handed down from the strenuous days of war. Many of these matters could not possibly have consideration in the warp and woof of business as it is being shaped to-day, and are best forgotten. At the same time firms who have the right perspective are strengthening their sales forces and selling equipment, for all are agreed that strenuous and more competitive days are ahead—if they have not already arrived.

"To wipe these things off and forget about them, so as to start anew with a clean slate, is the only business-like method," said B. J. McCormick, of the Canada Forge, Welland, to Canadian Machinery, recently. "There is a handicap in left overs and the same, it seems to me, applies to conditions confronting the dealer as well as the manufacturer. Cash on hand is more useful to the dealer than shelves full of stagnant stock, bought at prices which the public will not meet, for ready money makes possible the purchase of new goods at present values and puts the merchant on an up-to-date selling basis. There is sometimes better strategy in taking a loss than in sitting tight. A strategic loss nowadays seems to be essential to the most effective offensive."

Ratepayers of Midland decided to grant a fixed assessment of $35,000 to Mason and Co., for the extension of their sawmills, and a similar exemption to Manley Chew for the construction of a fibre board plant.

Notice has been given to the effect that the Winnipeg assembling plant of the Ford Motor Company of Canada, which has been closed since November, will reopen on January 12. It is announced that no cut in wages will be made.

The unemployment situation is much brighter in Stratford as the local factories, which closed down for stock taking and the holiday season, have resumed operations with practically full staffs.

Anglin-Norcross Ltd., 65 Victoria St., Montreal, have received the general contract for extension to factory for the Standard Paint Co., of Canada, 52 Victoria Sq.

The contract for electrical work on $300,000 theatre being erected in Victoria, B. C., by the Famous Players Canadian Corp. has been awarded to the C. H. E. Williams Co., 509 Richards St., Victoria.

PERSONAL

Mr. D. F. Griffith, sales manager of B. Greening Wire Co., Ltd., Hamilton, is in New York on business. He will be absent about ten days.

Mr. George Bertram, sales manager of the Lincoln Electric Company of Canada, is in Cleveland, Ohio, this week, on business.

M. H. Wood, who for the past year has been conducting a jobbing machine shop at Aylmer, Ont., has disposed of his interests there. Mr. Wood has removed to Toronto and is now on the sales staff of the National Electro Products, Ltd., manufacturers of oxygen and hydrogen gases for welding purposes.

D. M. McLean, formerly chief engineer of the Dover Boiler Works, Dover, N. J., general sales manager of the L. & I. J. White Company, Buffalo, N.Y., etc., and for the past four years manager of the publicity department of the Canadian Ingersoll-Rand Company, Sherbrooke, Quebec, recently left the latter company to assume control of C. & C. Limited, Rock Island, Quebec, manufacturers of fancy biscuits and candies. Mr. McLean's son, F. A. McLean, A.M. C.M.I., and formerly with the Crocker-Wheeler Company, Lackawanna Steel Company, McKiernan Terry Core Drill Company, etc., and latterly general assistant publicity department Canadian Ingersoll-Rand Company, has been appointed as his successor.

OBITUARY

The death occurred on January 7 of Edward G. Little, engineer of the local Hydro power plant, at Erindale, Ont.

J. C. Kennedy, C.E., died very suddenly at Owen Sound on New Year's day. He was formerly city engineer of that city.

Charles W. McGuire, manager of the Imperial Oil Co., London, Ont., died on January 9th at his home, 799 Hellmuth avenue, following several weeks' illness from heart trouble. Mr. McGuire was one of the most prominent Masons in Western Canada.

What's This?—A wireless message from Moscow saying that a great many mechanics from Detroit, Mich., are now working in the Donetz coal basin of Russia has caused considerable speculation in diplomatic circles, coming after reports from Berlin to the effect that 4,000 United States citizens now in Germany are going to the same region to man the factories. Most of these men are said to be experienced in automobile construction.

NEW CATALOGUES

The Automatic Transportation Co., Buffalo, N.Y., have sent us several of their publications. These include bulletin 25, which describes their automatic tiering lifting truck; bulletin No. 26 which describes their automatic storage battery industrial trucks, tractors and engines, and a booklet entitled Conclusive Evidence, which shows copies of various letters received from satisfied customers. Another booklet tells the story of their type L electric lifting platform truck.

The Cleveland Twist Drill Co., Cleveland, Ohio.—A very useful handbook for drillers. This little volume is prepared for the use of drillers. The parts of a twist drill are first discussed, points of grinding are talked on, this including all the common errors. The third chapter is devoted to drill speeds and feeds, while chapter four is full of miscellaneous helps. The last chapter tells of some common errors and their results, while a few remaining pages discuss certain products.

Armstrong-Whitworth of Canada, Ltd., Montreal.—Brochure No. 11, which is devoted to A. W. non-ferrous products. This booklet illustrates various of their lines and particulars of the same.

The L. S. Starrett Co., Athol, Mass, have issued a new catalogue that contains information on about twenty-one new tools not included in previous catalogues. Some of the new tools included are a universal bevel protractor, a micrometer caliper gauge, a tool-maker's button, a metric micrometer caliper, and others.

The Chicago Flexible Shaft Co., Chicago, Ill.—Catalogue No. 56, dealing with gas and oil blast furnaces for the heat treatment of metals. A table is given showing the proper type of furnace for certain classes of work. Combination furnaces, high speed steel furnaces, barium chloride furnaces, bench oven furnaces, annealing tool and die heating oven furnaces, cyanide hardening furnaces and others are included in this book.

The Langhaar Ball Bearing Co., Aurora, Ind.—A catalogue dealing with Langhaar self-adjusting ball bearings. A complete description of this type bearing is given, also some illustrations of typical installations.

The Canadian Atlas Crucible Steel Co., Ltd., Welland, Ont.—A catalogue dealing with their various lines of tool steels. Various hints as to the working of the different steels are also given.

The Landis Machine Co., Waynesboro, Pa. A very useful handbook for all operators of Landis threading machinery. Instructions for grinding the chasers is given. Care and operation of die heads for the different machines, certain don'ts, which should be read carefully, special threads and other interesting subjects are discussed in this valuable aid which is edited by C. F. Meyer and C. H. Kirkpatrick.

The McDonough Manufacturing Co., Eau Claire, Wis.—A catalogue devoted to the Sterling universal tool grinder. Various photographs are shown which illustrate the machine's adaptability for various classes of work. A full description of the design is also given. Another book describes their cylindrical grinders in detail.

The Oliver Instrument Co., Adrian, Mich. A book devoted to their varied line of filing machines. These machines are explained fully and their capacities are stated in each case. Examples of work performed are also shown.

The Wright Manufacturing Co., Lisbon, Ohio.—Catalogue No. 10, dealing with their steel hoists, hand cranes and steel trolleys. The construction of these hoists is given, also specifications. Various photographs of installations are shown.

The Quigley Furnace Specialties Co., New York. -A little booklet dealing with their line of Q metallic alloys. The uses of their alloys are explained. Carbonizing boxes, cyanide and lead pots, tubes, retorts and sheets are shown all made from Q alloys. It is stated that these alloys can be welded, machined or fabricated as desired.

The Ross Heater & Mfg. Co., Inc., Buffalo, N.Y.—Catalogue F, dealing with the Ross heater. This heater is of the closed or tubular type. They are used for heating all kinds of fluids and the customary heating medium is steam. The common liquid heated is water, but oil, sugar juice, chemical compounds, or any other liquid can be heated. There are two types of heaters, instantaneous and storage. Various photographs, specifications and sectional views are given in this catalogue.

The Hanna Engineering Works, Chicago, Ill.—Catalogue No. 3. A very complete catalogue dealing with compression yoke riveters; 48 pages are filled with real, live information, showing details of construction, specifications and completed riveters of various types. This concern have also sent us a book of instructions that should be in the hands of anyone operating one of their riveters. It is full of practical and valuable hints that should save any trouble in operating, not to speak of obtaining maximum production. They also have a catalogue No. 10 that deals with their line of foundry moulding machines in splendid detail.

Hardinge Bros., Inc., Chicago, Ill.—A very complete catalogue dealing with their line of precision bench lathes and attachments. This book is filled with illustrations of all kinds of lathes and discusses the chucks used, etc., etc. Small milling machines for bench use, tool stands, saws, emery paper discs and in fact all parts for precision tools are produced by this concern. The catalogue has 116 pages and is a small encyclopedia in itself.

Terrell's Equipment Co., Grand Rapids, Mich.—A catalogue describing their line of steel cupboards, wardrobes, lockers, shelving and bench drawers. Different arrangements are shown and all dimensions of the various sections are stated.

The Wheel Trueing Tool Co., Detroit, Mich.—A catalogue dealing with all types of diamonds for industrial use. Holders of various natures are shown, also glaziers' tools. Diamond pointed tools are also described.

The Electric Furnace Co., Alliance, Ohio.—Booklet 9B, dealing with Baily electric furnaces. These furnaces are of various types and are used for melting non-ferrous metals, annealing and the general heat treatment of steels.

The Sibley Machine Co., South Bend, Ind.—A catalogue dealing with their various lines of drill presses. The various sizes are discussed in detail and the catalogue is well illustrated throughout.

Internal Grinding Machine.—Swing, 6 in. inside of water guard; 10 in. with water guard removed. Length that can be ground, 3¾ in. Diameter that can be ground, from 1¼ to 2 in. Wheel table has two traverse speeds, 34 and 78 in. per min. respectively. Workhead has three rotative speeds, 180, 325 and 590 r.p.m. respectively. The work spindle has a 13-16 in. hole clear through. The centre line of the spindle is 46 in. from the floor. Front bearing of work spindle is 1⅝ in. and the rear bearing 1¾ in. in diameter. The countershaft which, together with one grinding head, assortment of grinding wheels, and the necessary wrenches, is included in the machine equipment, runs at 600 r.p.m. and has a pair of tight and loose pulleys 10 in. in diameter by 2¾ in. face. The pump and water tank are extra. Floor space occupied is 28 by 56 in. The net weight of the machine is 1,300 lb.; crated for domestic shipment, 1,600 lb.; and boxed for ocean shipment, 1,800 lb.

Closed the Plant.—The Martime Nail Works, St. John, N.B., closed on December 31st, for an indefinite period. As a result two hundred men are thrown out of employment, and the business interests of the city will be deprived of a payroll approximating $25,000 a month. Mr. Elkin, Managing Director, informed the Canadian Press that the works would be reopened when the men employed are ready to accept a wage schedule consistent with conditions in the steel market to-day.

New Radiator.—The Hamilton Tool Co., Ltd., Hamilton, Ont., have recently perfected a new radiator particularly adapted for trucks and tractors. The tubes are of seamless copper tubing held in place by a packed nut. In case of a frozen or otherwise damaged tube it is claimed this radiator can be dismantled, tube replaced and radiator mounted again in about thirty minutes' time. One motor truck manufacturer is already using this radiator on all trucks now building.

In New Office.—The Delora Smelting & Refining Co., Ltd., manufacturers of Stellite tools and cutting metal, are now in the new office, 1404 C. P. R. Bldg., Toronto. In future all shipments will be made direct from Delora, Ont. Sales and service departments remaining in Toronto.

Classified Opportunities

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631, Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

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WANTED NEW AND RE-MANUFACTURED [illegible] engines, boilers, saw-mill machinery, planing mill and sash and door factory machinery. New and manufactured [illegible] machinery. Electric motors, [illegible] direct connected steam operated generators, portable electric tools. Builders' hoists [illegible] Canadian Machinery.

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1 D-1 H. D. Colburn Drill.

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110 Volts, 125 Amp.

Pratt & Whitney Turrets.

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LONDON

Hale St., London, Ont.

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Sale by tender of woodworking machinery, lathes, shapers, grinders, motors, pulleys, shaftings, tools, etc., used in the Training Classes of the Department of Soldiers' Civil Re-establishment.

Tender forms can be obtained from the Department's Sales Officer at 590 King Street West, Toronto, where the above is on view.

Act quickly. Tenders will close January 14th.

FOR SALE

STELLITE WE HAVE A LARGE QUANTITY of No. 2 Stellite in the right number for lathe or planer work. Standard squares and rectangles at $2.50 per lb. Midland Engine Works Co., Midland, Ont. (c2m)

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Machinists, special machinery made to order, repairs, cylinder grinding, pistons, rings and wrist pins. Satisfaction guaranteed. (c2m)

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Automatic Steam Towing Machine, Ship Windlasses, [illegible] Steam Capstan, [illegible] Steering Engine, Hydraulic Freight Hoist, [illegible] machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont.

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Machinery and Supplies
285 Beaver Hall Hill - MONTREAL

HELP WANTED

SALESMAN I WANT A MAN ABLE TO ORganize the sale of a good gasoline engine and other farming implements all over the Dominion of Canada. Give reference, state previous employment and salary. Apply Box 741, Canadian Machinery. (ctfm)

GENERAL MANAGER REQUIRED IMMEDIately for small engineering works in Ontario employing about 100 men and comprising machine shops and grey iron foundry manufacturing machine moulded castings, must be thoroughly experienced in this class of work and competent to take entire charge, including office and sales end of the business; preference given to one having experience in agricultural machinery; good prospect for energetic man; apply, stating age and salary required and give references; applications will be treated in confidence. Box 745, Canadian Machinery. (c4m)

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WANTED RESPONSIBLE ENGINEERING firm wants Blue Prints and use of patterns or Blue Prints and one set of Castings each, of Planer about 16" x 16", Horizontal Boring Mill and Pipe Bending Machines, various sizes. Above wanted for advertiser's own shop and not for selling purposes. State what you can offer and terms to M. T. L., Ltd., P.O. Box 1185, Montreal. (c2m)

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25 Cycles

Generator K.W.	Volts	R.P.M.	MAKER	Turbine. K.W.	Pressure
500	400	1500	WESTINGHOUSE-PARSONS	500	150 lbs.
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750	440	1500	WESTINGHOUSE	750	
850	380	1500	WESTINGHOUSE-PARSONS	750	150 lbs
1000	2300	1500	WESTINGHOUSE	750	150 lbs.
1000	550	1500	ALLIS-CHALMERS-RATEAU	1000	
1250	6600	1500	WESTINGHOUSE	1000	140 lbs.
1500	370	1500	GENERAL ELECTRIC-CURTIS	1250	175 lbs.
2500	2400	1500	WESTINGHOUSE	2500	150 lbs
5000	11000	500	GENERAL ELECTRIC-CURTIS	5000	175 lbs.
6500	6600	750	ALLIS-CHALMERS	6500	175 lbs

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1 No. 3½ Greenard Arbor Press.
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50 No. 1 Racine High Speed Saws.
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1—12 4-sided Sticker.
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1—12" Round Cylinder Buzz Planer.
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A full line of Elliot Woodworking Machinery, and Belleville Motors. Complete woodworking outfit for sale, consisting of all up-to-date machinery. Will be disposed of, complete or separate. List sent on application.

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1/2 x 20 inches, per lb.	17 1/2c.

C.W. Norway Imported Welding Rods, for Wrought Iron and Steel

3/16 x 36 inches, per lb.	$0.23
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3/32 x 36 inches, per lb.	.22
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1/4 x 36 inches, per lb.	.20

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5/32 x 12 inches, per lb.	$0.80
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C.W. Scaling Powder, for Cast Iron

1-lb., 2-lb., and 5-lb. cans, per lb.	$0.25

C.W. Flux Powder, for Brass, Bronze, Copper

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3/8 x 24 inches, per rod	$0.45
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1/2 x 6 x 24 inches, per block	3.00
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C.W. Goggles, per pair (in green)	$2.00
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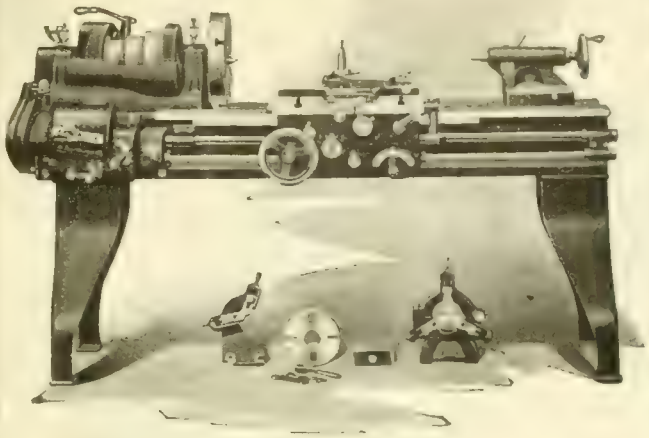

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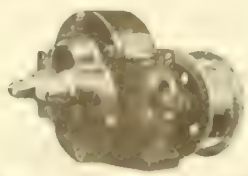

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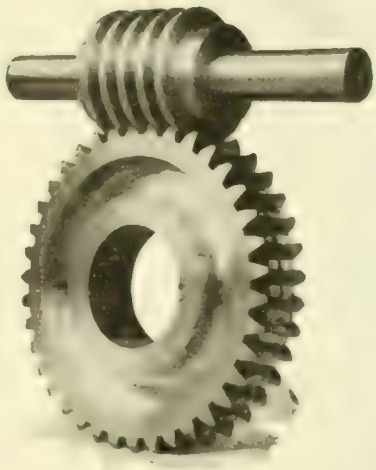

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Fisher Motor Co., Ltd., Orillia, Ont.
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Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
Baird Machine Co., Bridgeport, Conn.
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Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia, Pa.

Bars, Bronze Cored
Moore & Sons, Thos., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Illingsworth Steel Co., John, New York City, N.Y.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Wilkinson & Kompass, Hamilton, Ont.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Tallman Brass & Metal Co., Hamilton, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Roller
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Clamps
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
[illegible], Montreal, Que.
[illegible] Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
[illegible] Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Lacing
[illegible] Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing Machines
[illegible] Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
[illegible] Belting Co., J. C., Montreal, Que.
[illegible] H. W., Toronto, Ont.

Belt Tools
[illegible] & Knight Mfg. Co., Worcester, [illegible]

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
[illegible]

Belting, Fabric
[illegible] Inc., E. C., Indianapolis, I.
[illegible] lated Rubber Co., Ltd., [illegible]

Belting, Leather
[illegible]

Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
[illegible]
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
[illegible], Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Carborundum Co., Niagara Falls, N.Y.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
[illegible]

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
[illegible] & Son Co., Ltd., The John, Dundas, Ont.
[illegible]
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
[illegible]
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
[illegible] land, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
[illegible] City, N.Y.

Blocks, Pillow
[illegible]

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
[illegible]
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
[illegible]

Bolt and Nut Machinery, Automatic
[illegible]

Bolts and Nuts
[illegible]

Bolt Threading Die Heads
[illegible]

Boosters
[illegible]

Boring and Turning Mills, Vertical
[illegible]

Boring, Drilling and Milling Machines, Horizontal
[illegible]

Gisholt Machine Co., Madison, Wis.
[illegible]
Universal Boring Machine Co., Hudson, Mass.

Boring, Drilling and Milling Mach., Vertical
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
[illegible] Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Bricks, Fire
[illegible], Hamilton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.

Bronze
[illegible] Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Bronze, Phosphor
[illegible] Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
[illegible]

Bulldozers
[illegible]
Ryerson & Son, Jos. T., Chicago, Ill.

Burners, Oil and Gas
[illegible]
Montreal, Que.
[illegible] W. S., New York City.

Bushings
[illegible]

Calipers
[illegible]

Cams
[illegible]

Can-Making Machinery (See Sheet Metal Working Machinery)
[illegible]

Cars, Ore
[illegible], Que.

Castings, Aluminum
[illegible]

BUYERS' DIRECTORY

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver Harris Co., Walkerville, Ont.
Fleck Ltd., Alexander, Ottawa, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Castings, Copper

Castings, Marine

Castings, Die Molded
Franklin Die-Casting Corp., Syracuse, N.Y.

astings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que

astings, Iron
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Bernard Industrial Co., A., Fortierville Que
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Electric Castings Co., Ltd., Orillia
Fleck Ltd., Alexander, Ottawa, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Hiram, Walkerville, Ont.

Castings, Hyd. Press

Castings, Monel Metal
ville, Ont.

Castings, Nichrome
Electric Steel & Engineering Co., Welland, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

astings, Nickel
onto, Ont.

Castings, Semi-Steel
Electric Steel & Engineering Co., Welland, Ont.
Hull Iron & Steel Foundries, Hull, Que
Katie Foundry Co., Galt, Ont.
peg, Man.

astings, Steel
Kennedy & Sons, Wm., Owen Sound, Ont
Swedish Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron

Centering Machines

Chains (See Sprockets and Chains)

Chains, Driving

Chasers

Chemists

Chucking Machines
Co., of Canada, Ltd.
Drill

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Goodell & Pratt Co., Greenfield, Mass.
Ingersoll, Ont.
Bedford, Mass.
Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Dundas, Ont.
Cushman Chuck Co., Hartford, Conn
Dom. Steel Products Co., Brantford, Ont.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Dundas, Ont.

Chucks, Planer
Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd.,

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Cataract Refining Co., Toronto, Ont.

Compressors, Air

Compressors, Air and Gas
Can. Ingersoll Rand Co., Ltd., Sherbrooke,
Garlock-Walker Mchy. Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction

Connecting Rods and Straps

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que
Main Belting Co. of Can., Montreal, Que.
Hope, Ont.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cotter Pins
Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Starrett Co., L. S., Athol, Mass

Countershafts
Dundas, Ont.
land, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Dundas, Ont.

Couplers, Car and Locomotive

Couplings, Flexible

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Falls, Ont
Northern Crane Works, Walkerville, Ont

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que

Cranes, Traveling
Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Falls, Ont.
Northern Crane Works, Walkerville, Ont

Crank Pin Turning Machines
Garlock-Walker Mchy Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia Pa

Cutters, Flue
Holden Co., Ltd., Montreal, Que

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll, Ont
Kearney & Trecker Co., Milwaukee, Wis
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling

Cleveland Milling Machine Co., Cleveland.
Elliott & Whitehall Tool Co., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass
Pilot Steel & Tool Co., Montreal, Que.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que

Cutting Oil Filters (See Oil Filtering Systems)
Bowser & Co., Inc., S. F., Fort Wayne, I.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Dealers, Machinery (See Searchlight Section)
Ford Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Geometric Tool Co., New Haven, Conn
Herbert Ltd., Alfred, Toronto, Ont
Jones & Lamson Machine Co., Springfield, Vt
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Bedford, Mass.

BUYERS' DIRECTORY

Murchey Machine & [illegible], Mich.
National Acme Co., Cleveland, O.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., [illegible], Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
[illegible]

Dividing Heads
[illegible]
Ford-Smith Machine Co., Hamilton, Ont.
[illegible]
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Carborundum Co., Niagara Falls, N.Y.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
[illegible]
Can. Blower & Forge Co., Ltd., Kitchener.
[illegible]
Henry & Wright Mfg. Co., Hartford, Conn.
High Speed Hammer Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., [illegible], Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker [illegible]
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., [illegible], Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Drilling Machine Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
[illegible] Galt, Ont.
[illegible]
Holly, R. S., Toronto, Ont.
[illegible]

Drilling Machines, Multiple Spindle
[illegible]
Dundas, Ont.
[illegible]
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
[illegible] Que.

Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Haskins Co., R. G., Chicago, Ill.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., [illegible], Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
[illegible]
Toomey Inc., Frank, Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
[illegible]
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
High Speed Hammer Co., Rochester, N.Y.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., [illegible], Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
[illegible]
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
[illegible]
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
[illegible]

Drills, High Speed Twist
[illegible]
Can. Detroit Twist Drill Co., Walkerville, Ont.
[illegible]

Drills, Ratchet
[illegible]

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
[illegible]
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
[illegible]

Elevators and Conveyors
[illegible]
Jones & Glassco, Montreal, Que.
[illegible]
Main Belting Co. of Can., Montreal, Que.
[illegible] Hope, Ont.

Emery Cloth
[illegible] Chicago, Ill.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Carborundum Co., Niagara Falls, N.Y.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
International Machinery & Supply Co., Montreal, Que.
[illegible]

Engines, Capstan
[illegible]

Engineers, Mechanical
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
[illegible]

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Northern Electric Co., Montreal, Que.
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
[illegible]
Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fibre
[illegible]

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
[illegible]
Montreal, Que.
[illegible]

Filing Machines
[illegible]

Filler, Iron (See Cements, Iron)

Fire Extinguishers
[illegible]

Fittings, Pipe
[illegible]

Flexible Shafts
[illegible]

Flux, Galvanizing
[illegible]

Fluxes, Welding
[illegible]

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
[illegible] Toronto, Ont.

Forgings, Hammer
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
[illegible]
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid
[illegible]

Fuel Oil Burning System
[illegible] Montreal, Que.

Furnaces, Electric
[illegible] delphia, Pa.
[illegible] Montreal, Que.

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
[illegible]

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
[illegible] Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
[illegible]
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
[illegible] delphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
[illegible]

Furnaces, Tempering and Annealing
[illegible] delphia, Pa.
[illegible]

Furniture, Machine Shop
[illegible]

Gages, Dial
Herbert Ltd., Alfred, Toronto, Ont.
[illegible]

Gages, Measuring (See Tool Work)
[illegible]

Gages, Recording
[illegible]

Gages, Snap, Thread and Cylindrical
[illegible] of Canada, Ltd.

Gages, Special Measuring (See Tool Work)

Gages, Standard
[illegible]

BUYERS' DIRECTORY

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson, Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Garnet, Emery and Flint Paper and Cloth
Rubber Supply Co., Toronto, Ont.
[illegible] Chicago, Ill.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto, Ont.

Gaskets
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que
[illegible] Mfg. Co., Jersey City, N.J.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que
Dom. Foundries & Steel, Hamilton, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co., Providence, R.I.
Fellows Gear Shaper Co., Springfield, Vt
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Dom. Foundries & Steel, Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R I
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Diamond State Fibre Co., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Steel Products Co., Brantford, Ont
Ford-Smith Machine Co., Hamilton, Ont
Gardiner & Son, Robt., Montreal, Que
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia, Pa
Renold (Hans) of Canada, Ltd., Montreal, Que

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Can. Steel Foundries, Montreal, Que

Gears, Rawhide (See Gears, Cut)
Philadelphia Gear Works, Philadelphia Pa

Gear, Silent Chain
Gardiner & Son, Robt., Montreal, Que
Morse Chain Co., Ithaca, N.Y.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont

Generators, Electric
Holden Co., Ltd., Montreal, Que
Northern Electric Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont
Sturtevant Co., B. F., Boston, Mass

Goggles, Safety
[illegible]
[illegible]
[illegible]
[illegible]

Grab Buckets
[illegible]
[illegible]
[illegible]
[illegible]

Grease Cups, Pressed Steel and Brass
[illegible]

Greases, Lubricating
[illegible]
[illegible]

Grinding Discs
[illegible]
[illegible]

Grinding Machines
[illegible]

Grinding Machines, Abrasive Belt
[illegible]
[illegible]

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Goodell & Pratt Co., Greenfield, Mass.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Works, Grand Rapids, Mich.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co., Waltham, Mass.
Terry & Co., John C., Birmingham, Eng.
Streinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Machine Co., Greenfield, Mass
Manhattan Machine & Tool Works, Grand Rapids, Mich.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont
Holden Co., Ltd., Montreal, Que

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa
National Acme Co., Cleveland, Ohio
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.
Wilkinson & Kompass, Hamilton, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que
Manhattan Machine & Tool Works, Grand Rapids, Mich.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
Carborundum Co., Niagara Falls, N.Y.
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Cleveland Pneumatic Tool Co., Toronto, Ont
Garlock-Walker Mchy. Co., Toronto, Ont
Haeseler Co., R. G., Chicago, Ill
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill
Wilkinson & Kompass, Hamilton, Ont
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Snagging
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont
La Salle Tool Co., Ltd., La Salle, Ill
Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wilkinson & Kompass, Hamilton, Ont
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Machine Co., Greenfield, Mass.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Works, Grand Rapids, Mich.
Modern Tool Co., Erie, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co., Waltham, Mass.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Carborundum Co., Niagara Falls, N.Y
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
International Machinery & Supply Co., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Garlock-Walker Mchy. Co., Toronto, Ont.
Goodell & Pratt Co., Greenfield, Mass.
Lyman Tube & Supply Co., Montreal, Que.
McKenzie Machinery Co., Guelph, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont
Brown, Boggs & Co., Ltd., Hamilton, Ont
Holden Co., Ltd., Montreal, Que

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill
Keller Pneumatic Tool Co., Grand Haven, Mich.
Ryerson & Son, Jos. T., Chicago, Ill

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont
Bradley & Son, Inc., C. C., Syracuse, N.Y
Brown, Boggs & Co., Ltd., Hamilton, Ont
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Ryerson & Son, Jos. T., Chicago, Ill.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto, Ont
Ryerson & Son, Jos. T., Chicago, Ill

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que
Terry & Co., John C., Birmingham, Eng
Williams Machinery & Supply Co., A. R., Montreal, Que

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Hose, All Kinds
Quaker City Rubber Co., Philadelphia, Pa.

Hose, Flexible
Gutta Percha & Rubber, Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton, Ont.

Hose, Steam, Suction, Water
Quaker City Rubber Co., Philadelphia, Pa.

Hose, Steel
International Machinery & Supply Co., Montreal, Que.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Jacks, Hydraulic
International Machinery & Supply Co., Montreal, Que.
Norton, A. O., Boston, Mass

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Jigs and Fixtures (See Tool Work)
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que
Crescent Machine Co., Ltd., Montreal, Q.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn
Elliott & Whitehall Tool Co., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Toomey Inc., Frank, Philadelphia, Pa.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

BUYERS' DIRECTORY

Lamps, Electric
[illegible]
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Ryerson & Son, Jos. T., Chicago, Ill
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo
McDougall Co., Ltd., R., Galt, Ont
Ministry of Munitions, London, Eng.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blashill Wire Machy. Co., Ltd., Montreal
Sidney Machine Tool Co., Sidney, Ohio
Steinle Turret Machine Co., Madison, Wis
Williams Machinery & Supply Co., A. R., Montreal, Que

Lathes, Horizontal Turret
[illegible]
[illegible]
Gisholt Machine Co., Madison, Wis
Herbert Ltd., Alfred, Toronto, Ont
[illegible]
McDougall Co., Ltd., R., Galt, Ont.
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

Lathes, Polishing (See Polishing and Buffing Machines)
[illegible]

Lathes, Relieving
Canada Machinery Corp., Galt, Ont
[illegible]
[illegible]

Lathe, Universal Hand
[illegible]

Lathe, Speed and Hand
[illegible]
[illegible]

Lathes, Spinning
[illegible]

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lighting Fixtures
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser & Co., Inc., S. F., Fort Wayne, I.

Machinists' Small Tools
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Goodell & Pratt Co., Greenfield, Mass.
Ker & Goodwin Machine Co., Brantford, Ont.
Ministry of Munitions, London, Eng.
National Machine Tool Co., Racine, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Ryerson & Son, Jos. T., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
[illegible]
[illegible]
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
[illegible] Smelting & Refining Co., Ltd., Montreal, Que
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont
Canada Metal Co., Ltd., Toronto, Ont
Can. Atlas Crucible Steel Co., Ltd., [illegible]
[illegible] Foundries, Montreal, Que
Deloro Smelting & Refining Co., Ltd., [illegible]
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont
International Nickel Co. of Can., Ltd., Toronto, Ont
Magnolia Metal Co., Montreal, Que
[illegible]
[illegible]
[illegible]
Walker & Sons Metal Products, Ltd., [illegible]

Metalite Cloth
[illegible]

Micrometer Calipers
[illegible]
[illegible]
[illegible]

Milling Attachments
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Milling Machine Co., Cleveland
Ford-Smith Machine Co., Hamilton, Ont
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Rockford Milling Machine Co., Rockford, Ill
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland
Ford-Smith Machine Co., Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng
Toomey Inc., Frank, Philadelphia, Pa

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Cincinnati Milling Machine Co., Cincinnati, Ohio
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont
Rockford Milling Machine Co., Rockford, Ill
Roelefson Machine & Tool Co., Toronto, Ont
Ryerson & Son, Jos. T., Chicago, Ill
Toomey Inc., Frank, Philadelphia, Pa
Williams Machinery & Supply Co., A. R., Montreal, Que

Milling Machines, Vertical
Cincinnati Milling Machine Co., Cincinnati, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Rockford Milling Machine Co., Rockford, Ill.
Williams Machinery Co., A. R., Toronto, Ont

Monel Metal
International Nickel Co. of Can., Ltd., [illegible]

Motors, Electric
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

Moulded Rubber Goods
[illegible]

Nickel Bars, Sheets, Wire, Etc.
[illegible] Toronto, Ont

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont

Nickel Silver
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.

Oil Filtering and Storage Systems
Bowser & Co., Inc., S. F., Fort Wayne, I.

Oil Storage Engineers
Bowser & Co., Inc., S. F., Fort Wayne, I.

Oils
Canadian Oil Companies, Ltd., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Stones
Carborundum Co., Niagara Falls, N.Y.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.
Gutta Percha & Rubber, Toronto, Ont.
International Machinery & Supply Co., Montreal, Que.

Packing, Rod and Steam
Quaker City Rubber Co., Philadelphia, Pa.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.
Gutta Percha & Rubber, Toronto, Ont.
International Machinery & Supply Co., Montreal, Que.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
[illegible] Corp., H. B., Philadelphia, Pa
Williams Machinery Co., A. R., Toronto, Ont.

Pipe Cutting and Threading Machines
Crane Ltd., Montreal, Que
Greenfield Tap & Die Corp., Galt, Ont.
[illegible]
Landis Machine Co., Inc., Waynesboro, Pa.
[illegible]
[illegible]
[illegible]
Williams Tool Corp. of Can., Ltd., Brantford, Ont

Pipe and Nipple Threading Machines
[illegible]

Pipe Fitters' Tools
[illegible]
[illegible]
[illegible]

Pipe Threading Die Heads
[illegible]

Piston-Ring Machines
[illegible]
[illegible]
[illegible]

BUYERS' DIRECTORY

Planers, Parallels
[illegible] Niagara Falls, Ont.

Planing Machines
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
[illegible] Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
[illegible] Ltd., [illegible] T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
[illegible] Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
[illegible], Frank, Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

Planing Machines, Rotary
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
International Machinery & Supply Co., Montreal, Que.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
[illegible] & Van Winkle Co., Ltd., [illegible]
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
[illegible] & Co., [illegible], Birmingham, Eng.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
[illegible] Orillia, Ont.

Presses, Arbor
[illegible] Kalamazoo, Mich.
National Engineering Co., Sarnia, Ont.
[illegible] H. W., Toronto, Ont.
[illegible] Co. of Can., Ltd., Chas. A., Walkerville, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
[illegible] & Forgings Co., Welland, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
[illegible] & Co., [illegible], Birmingham, Eng.

Presses, Forcing
[illegible] Kalamazoo, Mich.
[illegible] & Tool Works, Buffalo, N.Y.
[illegible] Glasgow, Scot.

Presses, Hydraulic
[illegible] Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll Rand Co., Ltd., Sherbrooke, Que.
[illegible] Ill.
Niagara Machine & Tool Works, Buffalo, N.Y.
Perrin Ltd., W. R., Toronto, Ont.
[illegible] Glasgow, Scot.
[illegible] A. R., Toronto, Ont.

Presses, Power
[illegible] N.Y.
[illegible] Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
[illegible] Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Wall Co., Inc., D. H., Buffalo, N.Y.
[illegible] Toledo, Ohio

Presses, Screw
[illegible]

Profiling Machines
[illegible] Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., [illegible]

[illegible]

Pullers, Metal
[illegible] Ltd., Montreal, Q.
[illegible] Owen Sound, Ont.
[illegible] & Supply Co., A. R., [illegible]

[illegible] and Paper Mill Equipment
[illegible]

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Electric Steel & Engineering Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.

Pumps, Lubricant and Oil
Bowser & Co., Inc., S. F., Fort Wayne, I.
Can. Blower & Forge Co., Ltd., Kitchener
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser & Co., Inc., S. F., Fort Wayne, I.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks Morse Ltd., Montreal, Q.
Can. Ingersoll Rand Co., Ltd., Sherbrooke, Que.
Electric Steel & Engineering Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Victor Tool Co., Waynesboro, Pa.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
[illegible] Tool Corp., Meadville, Pa.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Reamers, Solid
[illegible] Co. of Can., Ltd., Montreal, Que.
[illegible] Rock Island, Que.
[illegible] Walker[illegible]
[illegible] Cleveland, O.
[illegible] Geo. F., Montreal, Que.
[illegible]
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Reamers, Taper
[illegible]

Greenfield Tap and Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Taylor Tool Co., J. A. M., Toronto, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Respirators
Willson Goggles, Inc., Reading, Pa.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.
Ryerson & Son, Jos. T., Chicago, Ill.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Paper
Wausau Abrasives Co., Chicago, Ill.

Sand Equipment
Can. Link Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co., Chicago, Ill.

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
[illegible] Hamilton, Ont.
[illegible] Saw & Stamping Works, Buffalo, N.Y.
[illegible] Machinery & Supply Co., Geo. F., Montreal, Que.
[illegible] Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
[illegible] Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
[illegible] & Sons Co., Montreal, Que.
[illegible] Ill.

Sawing Machines, Power Hack
[illegible] Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock Walker Mchy. Co., Toronto, Ont.
McKenzie Machinery Co., Guelph, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton, Ont.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio

Screw Machines, Plain or Hand
Acme Machine Tool Co., Cincinnati, Ohio
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Second-Hand Machinery
(See Searchlight Section)
Petrie, Ltd., H. W., Toronto, Ont.

BUYERS' DIRECTORY

Separators, Moisture and Oil

Separators, Oil and Waste

Shafting

Shapers, Wood

Shears, Hand

Shears, Power
Canada Machinery Corp., Galt, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate

Sheet Metal Working Machinery
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Sheets, Nickel, Resist, Alloy

Side Frames, Locomotive

Slotting Attachments
National Acme Co., Cleveland, Ohio

Slotting Machines
Herbert Ltd., Alfred, Toronto, Ont

Solders
Montreal, Que

Special Machinery and Tools

Spectacles, Industrial

Springs

Sprockets and Chains

Squares

Stamping, Metal

Stamps, Steel

Stairways, Wrought Iron

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto, Ont.

Steel, Cold-Rolled Strip
Barnes Co., Wallace, Bristol, Conn.
Firth & Sons, Ltd., Thos., Montreal, Q

Steel Castings

Steel Forgings

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont
Toronto Iron Works, Toronto, Ont.

Steel, Tanks
Can. John Wood Mfg. Co., Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric

Steels, Alloy and Carbon
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que
Barnes Co., Wallace, Bristol, Conn
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can Steel Foundries, Montreal, Que
Firth & Sons, Ltd., Thos., Montreal, Q
Hillingsworth Steel Co., John, New York City, N.Y

Steels, High-Speed
Montreal, Que
Toronto, Ont

Steel, Magnet

Steel, Structural

Steel Tubing, Close Joint and Welded

Steel, Frames, Cast Steel

Steels, Shop

Straightening Machinery

Studs

Surface Plates

Swaging Machines

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que
Can. John Wood Mfg. Co., Ltd., Toronto

Tanks and Pumps, Oil
Bowser & Co., Inc., S. F., Fort Wayne, I.
Can. Ingersoll Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont
Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont
Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Tapes, Measuring

Tapping Machines and Attachments
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
International Machinery & Supply Co., Montreal, Que
Jardine & Co., A. B., Hespeler, Ont.
Bedford, Mass.
National Acme Co., Cleveland, Ohio
Taylor Tool Co., J. A. M., Toronto, Ont

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Mich
National Acme Co., Cleveland, Ohio
Victor Tool Co., Waynesboro, Pa

Teeth, Dredge Bucket

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que
Mitchell Machine & Tool Co., Detroit, Mich
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Thread Cutting Machines

Threading Machines
Geometric Tool Co., New Haven, Conn

Thread Lead Testing Machines

Thread-Rolling Machines

Tongs

Tool Cases

Tool Holders

Tool Markers, Electric

Tool Posts, Lathe

Tool Steels for all Purposes
Bertrams Ltd., Edinburgh, Scotland
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.
Ministry of Munitions, London, Eng.
National Machine Tool Co., Racine, Wis.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont
Wheel Trueing Tool Co., Detroit, Mich
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
Foss Machinery & Supply Co., Montreal, Que.
Prest-O-Lite Co. of Can., Toronto, Ont

Trackwork, Railway

Trackwork, Manganese Steel

Transformers

Transmission Machinery
Can. Link Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.

Transportation Systems (See Trucks)

Treated Bits
Can. Atlas Crucible Steel Co., Toronto, Ont.

Trolleys and Tramways

Trucks
ton, Ont

Trucks, Industrial Motor

Tube, Products

Tubing, Electric Welded or Oxy-Acetylene Welded

Tubing, Flexible

Tubing, Seamless Steel

Tubing, Seamless Steel, Brass and Copper

Tubing, Welded
International Nickel Co. of Can.,

Tubing, Welded Steel

Turbines, Water

Turret Heads

BUYERS' DIRECTORY

Turret Machines (See Lathes, Horizontal Turret)

Turrets, Tool Post

Unions, Pipe

Universal Joints

Valves

Valves, Rubber Pump
Quaker City Rubber Co., Philadelphia Pa

Vises, Drilling Machine

Vises, Metal Workers'

Vises, Milling Machine

Vises, Pipe

Vises, Planer and Shaper
Bertram & Son, Co., Ltd., The John, Dundas Ont
Hendey Machine Co Torrington, Conn
Hoosier Drilling Mach Co., Goshen, Ind
Kempsmith Mfg Co., Milwaukee, Wis
Superior Machine Co., London, Ont

Vises, Wood Workers'
Columbia Hdwe Division Cleveland O
Geo F. Machinery & Supply Co., Montreal, Que
Victor Tool Co., Waynesboro, Pa

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Barnes Co., Wallace, Bristol, Conn
Diamond State Fibre Co., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont
Goodyear Tire & Rubber Co of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que
Parmenter & Bulloch Co., Gananoque, Ont.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
Carter Welding Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont

Welding Filler Rods
L'Air Liquide Society, Toronto, Ont.
Perdue, W B, San Francisco, Calif
Prest-O-Lite Co of Can, Toronto, Ont

Welding Machines, Oxy-Acetylene
Davis Bournonville Co, Jersey City, N J
Holden Co, Ltd, Montreal, Que
L'Air Liquide Society, Toronto, Ont.
Perdue, W B, San Francisco, Calif
Prest O Lite Co of Can, Toronto, Ont

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co, Jersey City, N J
Holden Co, Ltd, Montreal, Que
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill
Union Carbide Co. of Can, Welland, Ont

Welding Supplies
British Smelting & Refining Co, Ltd, Montreal, Que.
Carter Welding Co, Toronto, Ont.
Davis Bournonville Co, Jersey City, N J
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont
Perdue, W B, San Francisco, Calif
Prest O Lite Co of Canada, Ltd, Toronto, Ont
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Electric
Volta Mfg Co., Welland, Ont

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co, Wallace, Bristol, Conn
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London O
Greening Wire Co, B, Hamilton, Ont
Northern Electric Co, Montreal, Que.

Wire Cloth
Can Wire & Iron Goods Co, Hamilton Ont

Wire Rope
Can Wire & Iron Goods Co, Hamilton Ont

Wire Straightening and Cutting Machinery
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Can., Toronto, Ont
Tallman Brass & Metal Co, Hamilton, Ont

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co, B, Hamilton, Ont
Walker & Sons Metal Products, Ltd, Hiram Walkerville Ont

Woodworking Machinery
Canada Machinery Corp, Galt, Ont
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co, Grand Rapids, Mich
Williams Machinery Co, A. R, Toronto Ont.

Wrenches, Drop Forged
Armstrong Bros Tool Co, Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont

Wrenches, Machinists'
Armstrong Bros Tool Co, Chicago, Ill
Canada Foundries & Forgings Co, Welland, Ont.

Wrenches, Pipe
Canada Foundries & Forgings Co., Welland, Ont.
Crane Ltd, Montreal, Que.
Greenfield Tap & Die Corp, Galt, Ont

Wrenches, Tap
Butterfield & Co, Inc, Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont

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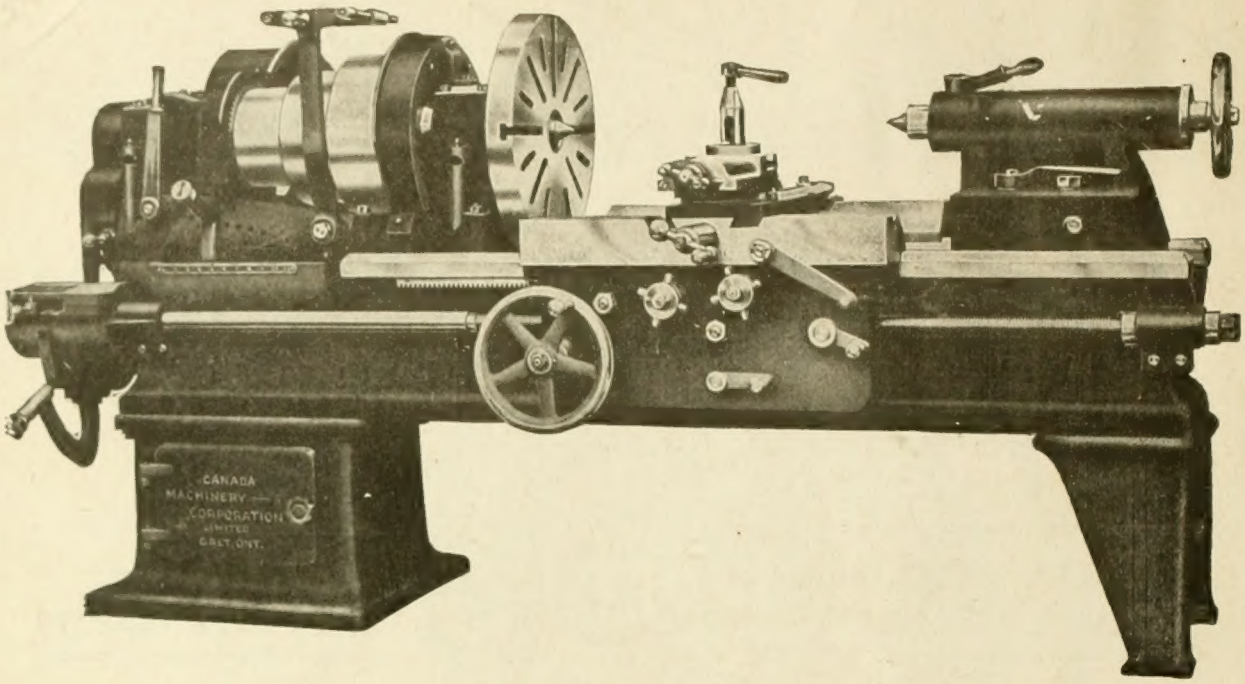

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